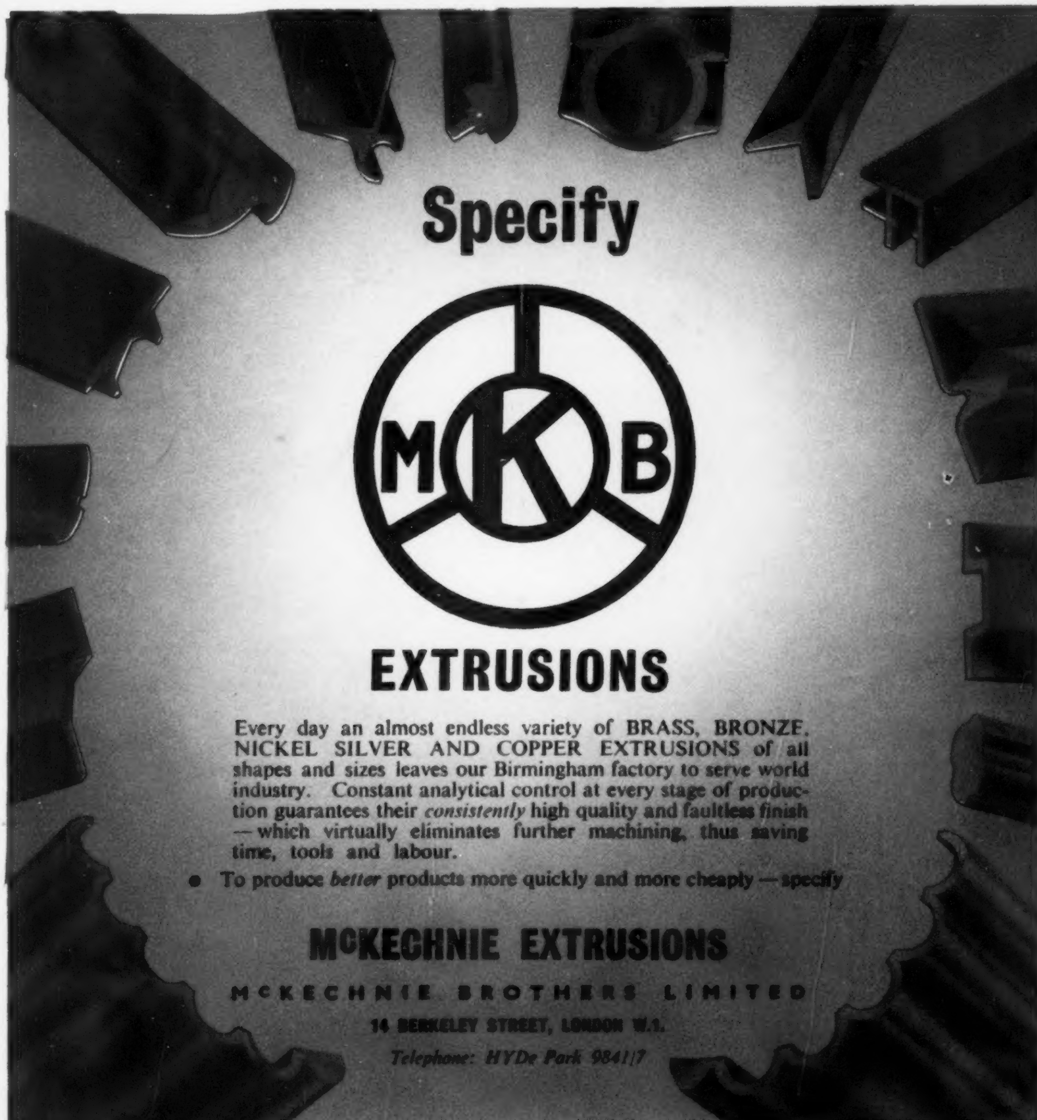
25 AUGUST 1961

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



VOL. 99 No. 8 ONE SHILLING

OA/7295

ABRAFRACT

offer

BARRELLING MATERIALS

Abrasive nuggets
Ceramic chips
Compounds

POLISHING/LAPPING MATERIALS

Aluminium Oxide
Silicon Carbide
Garnet *from 35 micron down to ½ micron*

all accurately graded

ABRAFRACT LTD., BEULAH ROAD, OWLERTON, SHEFFIELD 6 Tel: 348971

Manipulation

Individual skill and ingenuity also plays an important part in modern manufacturing techniques. If your design and production problems demand ingenuity and unequalled experience in sheet metal fabrication and assembly, call in Camelinat.

Specialists in design and complete unit production.

Camelinat

E. CAMELINAT & CO., LTD.,
CARVER STREET, BIRMINGHAM, 1
Phone: CENtral 6755 (5 lines)
Grams: Camelinat, Birmingham

Member of the Owen Organisation

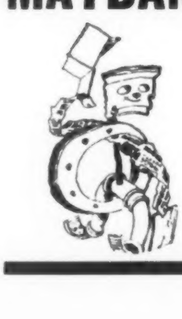
SM/EC 3773

PROFIT FROM YOUR SCRAP METAL

Contact the buyers of non-ferrous scrap metals.

Ask for Mr. Neal at:

MAYBANK METALS LTD



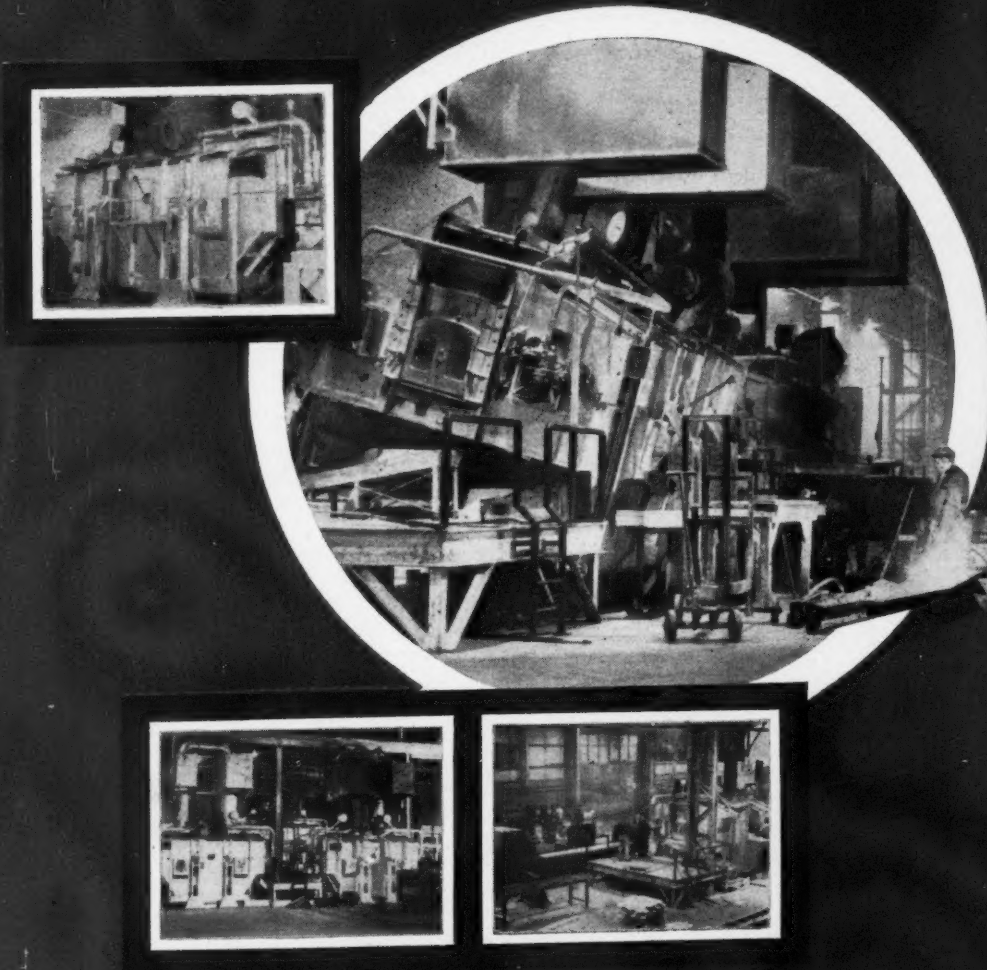
108, WOOTTON STREET, WATERLOO, LONDON, S.E.1.
Tel.: WATERLOO 4110, 7355

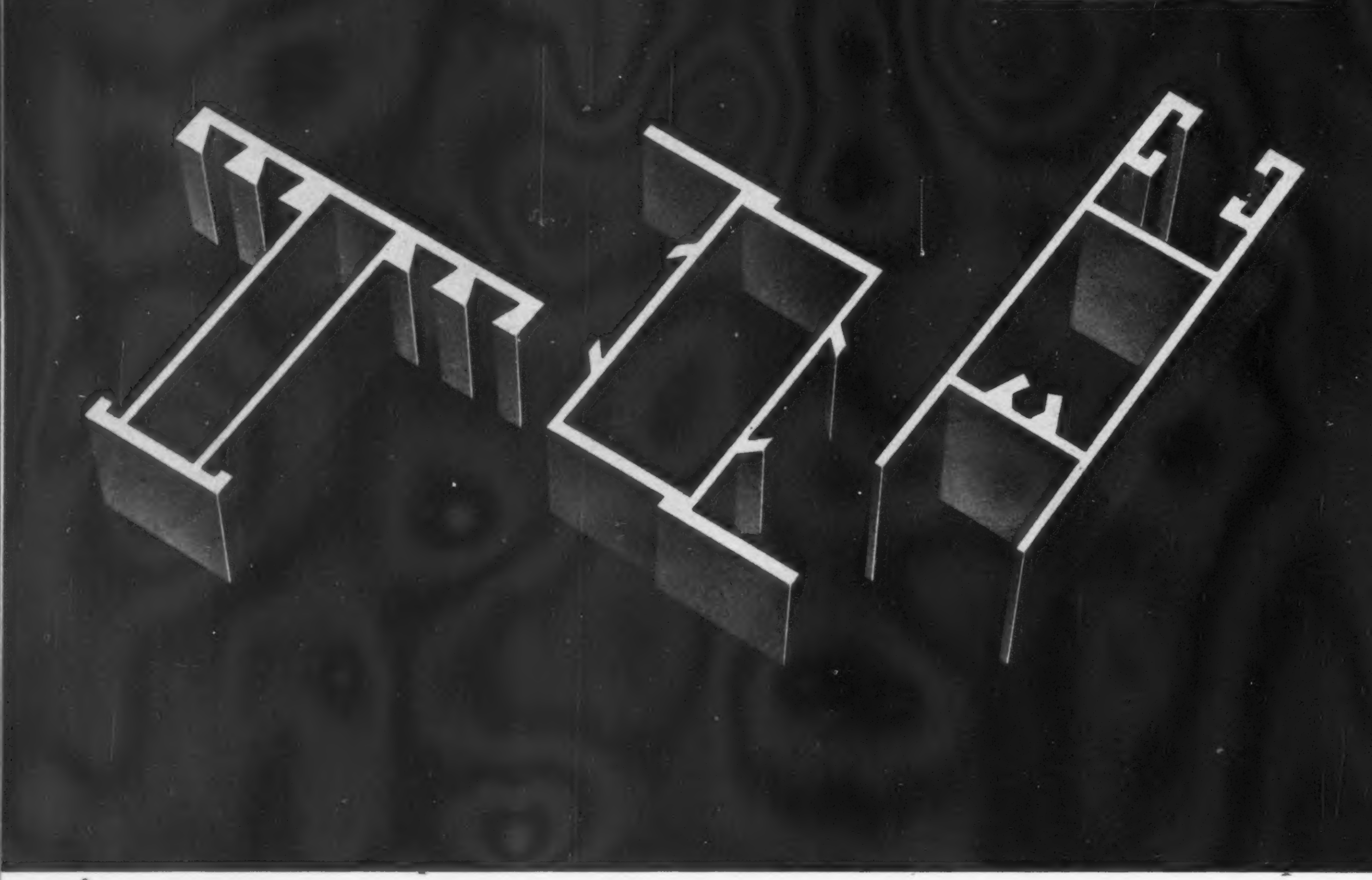
ONE OF THE

MAYBANK

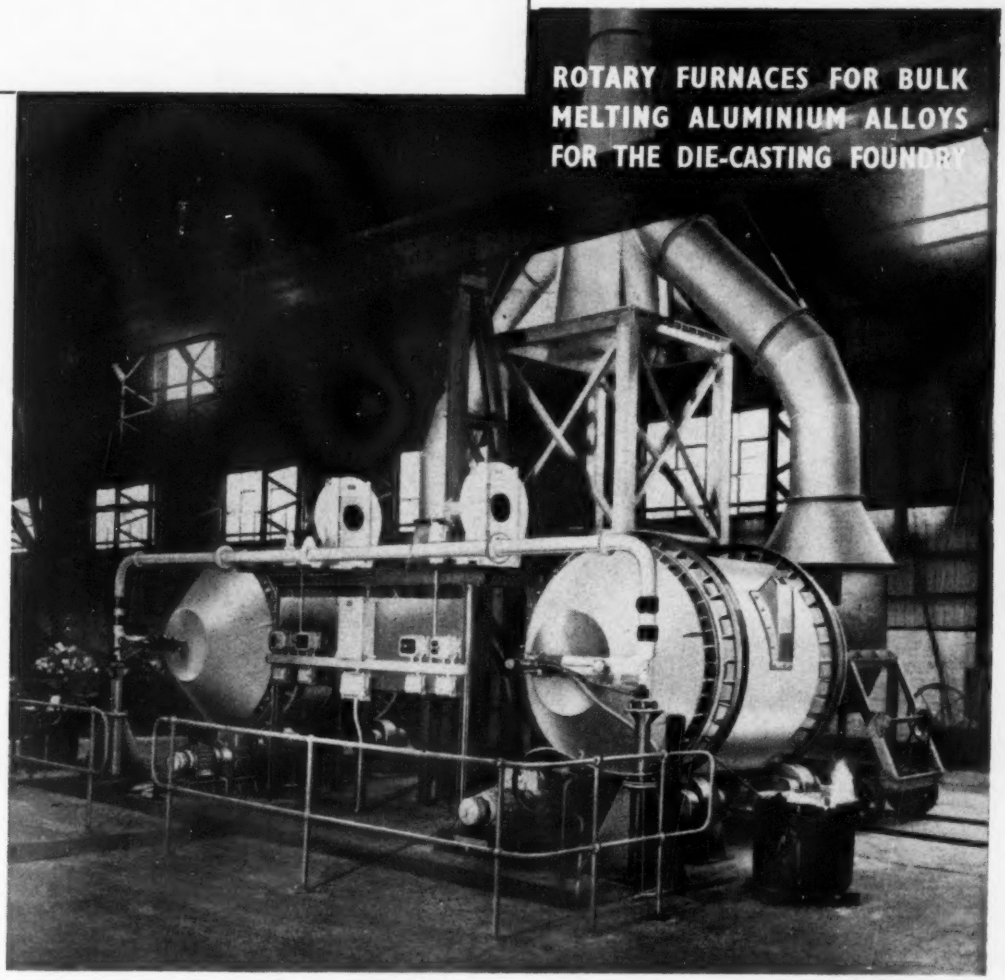
GROUP OF COMPANIES

Branches at: Higginshaw, Portsmouth, Edmonton, Gosport, Deptford, Woolwich, Strood, Waterloo





MONOMETER



Photograph of "Monometer" Oil-fired Rotary Melting Furnaces installed for the bulk melting of aluminium alloys of the Delta Metal Company at its Copper & Alloys Works, West Bromwich, in the new pressure Die-casting Foundry.

The reasons why they chose "Monometer" Rotary Furnaces

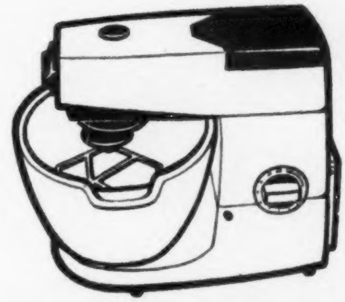
★ High thermal efficiency
★ Low Refractory consumption *(life of the linings average 2 years)*
★ Fast melting time
★ Minimum fuel consumption
★ Low maintenance costs
★ Comfortable working conditions for the operators
★ Push button control
★ Labour costs reduced to a minimum

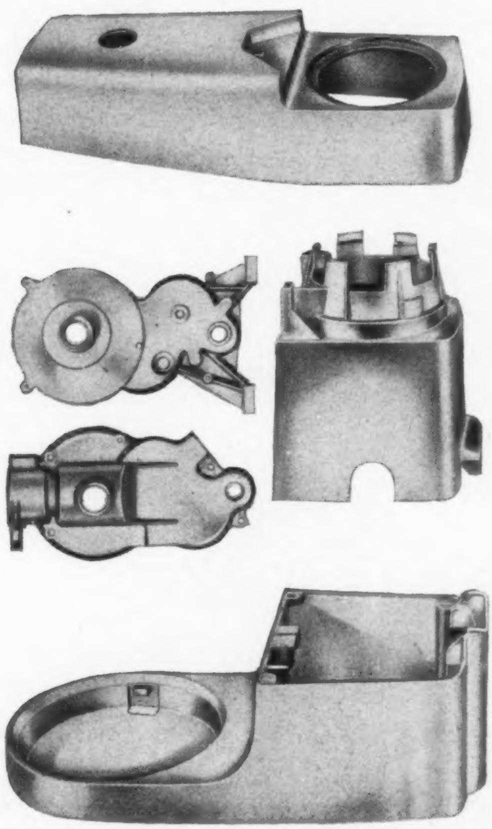
MONOMETER MANUFACTURING CO. LTD

SAVOY HOUSE, 115-116 STRAND, LONDON, W.C.2.

Telephone: TEMPLE BAR 9025

MIXTURE AS BEFORE





Consistent quality and reliability have once again enabled us to be chosen by Kenwood to supply the Pressure Die Castings for their new Chef Mixer.

With a background of over 40 years' experience, we can genuinely claim to be true specialists in the production of large and small Pressure Die Castings in Aluminium, Zinc and Magnesium Alloys.

All enquiries for Pressure Die Castings will receive the most prompt attention from our technical staff, and we invite you to consult our Product Design Service on any relative problems.

METAL CASTINGS DOEHLER LTD

WORCESTER

Phone: Worcester 21441 *Grams & Cables: METCAST, Worcester*

EDITOR
L. G. BERESFORD, B.SC., F.I.M.

MANAGING DIRECTOR
ARTHUR B. BOURNE, C.I.Mech.E.

METAL INDUSTRY

FOUNDED 1909

25 August 1961 Volume 99 Number 8

CONTENTS

PUBLISHED EVERY FRIDAY BY ILIFFE PRODUCTION PUBLICATIONS LTD.
Editorial Offices: 9 Charlotte Street, Birmingham 3. Telephone: Central 3206

Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1.
Tel.: Waterloo 3333. 'Grams: "Metustry, London-S.E.1"

Branch Offices: MANCHESTER : 260 DEANSGATE, 3; telephone, Blackfriars 4412 and Deansgate 3595 BIRMINGHAM : KING EDWARD HOUSE, NEW STREET, 2; telephone, Midland 7191. COVENTRY: 8-10 CORPORATION STREET; telephone, Coventry 25210. GLASGOW: 62 BUCHANAN STREET C.1 telephone, Central 1265/6

Annual Subscription
HOME £3 7s. 6d.
OVERSEAS £3 12s. 0d.
CANADA AND U.S.A. $10.00
Including one copy of Metal Industry Handbook Published Annually

METAL INDUSTRY

25 AUGUST 1961

VOLUME 99

NUMBER 8

Ore Processing Research

IN a recent issue (28 July 1961) we drew attention to the need for a modern research approach if adequate future mineral supplies are to be ensured. Particular emphasis was laid on the necessity for work on the application and adaptation of present control equipment to mineral processing, and the development of new processes more suitable for automation. Attention was also drawn to the possibilities of applying techniques from other industries to the problems of mineral extraction. In this connection it is interesting to note the success of the Mineral Processing Division of the Warren Spring Laboratory in those very fields. This is all the more gratifying because of latter years many of the developments in mineral processing have been of American origin.

When the Council for Scientific and Industrial Research set up this establishment in 1959 they aimed to provide a versatile laboratory for the benefit of industry and other Government departments, to carry out research which cannot be fitted into the programme of another research body. In reporting on the laboratory's first full year of operation in 1960, Sir Harry Jephcott, chairman of the Research Council and of the Laboratory's Steering Committee, says that these research facilities are being used to an increasing extent, and draws particular attention to the success of the Mineral Processing Division, which is a centre of research for the mining industry at home and overseas.

During 1960, work was undertaken on 22 repayment projects, representing in all three-quarters of the total work of the department. Six of the investigations were concerned with United Kingdom mineral deposits. The remainder dealt with overseas deposits and were carried out on behalf of various British companies, the United Kingdom Atomic Energy Authority and the Colonial Office. Surprisingly enough, primary base metal sulphide and oxidized sulphide ores, with one exception, have not appeared as subjects for applied research. Such is the interest, however, in rare-earth metals that the Committee have recommended that research on alloys containing individual rare-earth metals is desirable. Much of the current repayment work undertaken for industry is short-term, but the Committee are hopeful that this will lead to longer-term work. Anticipating the future needs of the industry, experiments are being planned to explore the possibilities of introducing automatic control with mineral dressing plants. A thorough investigation of the technique of minerals separation by high tension electrical methods has been started, which, it is anticipated, will result in the considerable extension of this technique. Already some anomalies, not explained by existing theory, have been revealed.

Platinum Mining at Rustenburg

By **C. B. Beath,** M.I.M.M., **R. J. Westwood,** B.Sc., M. Eng., and **C. A. Cousins,** M.Sc.

IN the two mines operated by Rustenburg Platinum Mines Ltd., the deposit forms part of the Merensky Reef Horizon of the Bushveld Igneous Complex. This reef, named after the geologist Hans Merensky, who was responsible for the prospecting programme that led to its discovery, produces nearly all of the platinum metals mined in the Union of South Africa. It comprises a layered pyroxenite horizon that has been traced continuously, except for a few minor breaks, around both the eastern and western limbs of the Complex. The prospected strike of the eastern limb amounts to 42 miles and that in the western limb to 70 miles. Of this great length of strike only 12 miles of outcrop are being actually mined down dip at the two mines operated by Rustenburg Platinum Mines Limited.

The platinum values are concentrated near the top and bottom contacts of a coarsely crystalline felspathic pyroxenite which has the characteristics of a pegmatite. Chromite concentrations also occur at these contacts and usually form two thin chrome seams.

This pegmatitic pyroxenite of the Merensky Reef is overlain by a pyroxenite band of similar composition but of a less coarsely crystalline structure, which may be referred to as the Merensky pyroxenite. This band grades rapidly at its upper contact into an anorthositic gabbro and this, in turn, is followed by a zone of mottled anorthosite.

In the Rustenburg mine the Merensky platinum reef averages about 1 ft. in thickness and reaches 2 ft. only in certain limited areas. This narrow width allows the whole pegmatitic pyoxenite, together with a portion of both the hanging wall and footwall, to be included in the stoping width mined.

At the Union mine the pegmatitic pyroxenite averages some 15-18 ft. in thickness. This thickness shows a gradual decrease from over 20 ft. in the north-eastern to less than 10 ft. in the south-western areas of the property. Platinum values are found near both the upper and lower contacts, but in the present workings the values at the upper contact are appreciably higher than those at the lower contact. As the distance between the two potential economic zones is far too great for them to be stoped together, and the average tenor of values on the lower zone normally falls below the level of payability, mining is confined to the zone near the upper contact.

Platinum values show a very low range of distribution, giving a very even tenor of values. The platinum is partly in the form of native metal, invariably alloyed with iron (ferroplatinum), and partly as the sulphide, arsenide and sulph-arsenides, these latter being in intimate association with sulphides of iron, nickel and copper.

At the Rustenburg mine the platinum compounds preponderate, while at the Union mine the ferro-platinum forms the major platinum mineral. Associated with the platinum are smaller proportions of the platinum group metals. Platinum forms the major component of the platinum group metals plus gold. Palladium is next in importance, with ruthenium, rhodium, iridium and osmium in descending order. Sulphides of iron, nickel and copper are always associated with the platinum. Chromite is also present and the highest platinum values occur in association with this mineral. The chromite itself does not contain platinum, which is in the interstitial silicate minerals.

Mining Methods

The reef mined at Rustenburg consists of a thin chromite-rich layer averaging ¾ in. in thickness with, above it, a layer of coarsely crystalline felspathic pyroxenite about 12 in. in thickness. The lower 9 in. of the Merensky pyroxenite above the reef and the upper 9 in. of the footwall anorthosite immediately below the chrome band contain platinum group metal values of small account.

It may be accepted generally that the platinum-bearing horizon covers a maximum stoping width of 30 in.; the surveyor's measured width in stoping operations has averaged 28½ in. over the past ten years. The strike of the reef is east-west and the dip is at 9° 30′ to the north. The reef strike tends to bend slightly northwards on the western half of the property in conformity with the curved shape of the Mafic zone.

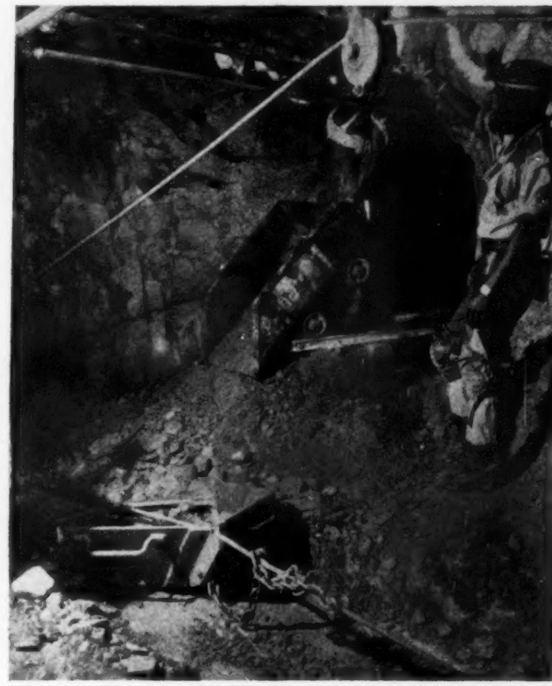
The strike and dip are most regular. This is also true of the mineral contents of the deposit. Over the life of the mine to date it has been found that while appreciable variations in value may occur from one sampling section to the next, yet the average values of ore reserve blocks show little variation. The few dykes encountered have had little or no influence upon the regularity of the deposit, while serious or even minor faulting is unknown.

Conditions of regularity of strike, dip and value have allowed the mine to be laid out in a simple and straightforward manner. The length of strike and the comparative shallowness of the deposit have made possible the rapid development of large areas of ground whenever a demand for platinum arose. Thus the output of the mine has followed world demand very closely.

The upper levels of the mine have been, and will be, largely worked from an incline and sub-incline haulage system, followed in depth by a vertical shaft. There are three vertical shafts in operation on the property, while a fourth will be sunk shortly. All three shafts are comparatively shallow, their depths being 500 ft., 780 ft. and 1,500 ft. respectively from surface. The west vertical shaft is a three-compartment timbered shaft with two skip hoisting compartments and a pump/ladderway. It has been in use for the past 12 years but ore in the area is almost exhausted and this shaft will shortly become an upcast ventilation shaft. The Waterval vertical shaft is a 15-ft. diameter concrete-lined shaft which serves the Waterval stoping area. Five-ton skips, interchangeable with double-decked cages, are installed.

The central deep shaft is a four-compartment shaft of "square-rectangular" section, measuring 24½ ft. by 11¼ ft. inside timbers. Single-decked cages capable of carrying 40 persons are installed in the two south compartments. These cages are sufficiently

This article, dealing with the geology of the platinum deposits at Rustenburg, the mining methods in use and the metallurgical treatment of the ore, appeared in "Platinum Metals Review" as an abridgement of a comprehensive Paper presented by the authors to the Seventh Commonwealth Mining and Metallurgical Congress. Rustenburg is the world's largest producer of the platinum metals and works in close association with Johnson, Matthey Ltd., who refine and distribute the metals produced by the mining company.



Ore is tipped from panel cars into the central gully scraper path

large to accommodate trucks of explosives, mining timber, etc. Skips are of five-ton capacity and are interchangeable with double-decked cages capable of carrying 40 persons. The choice of the "square-rectangular" shaft section was made for two reasons—to ensure a large volume of air being delivered to the underground workings and to facilitate the loading of men and material into large-sized cages.

A headgear of comparatively light construction is erected at all three vertical shafts. The ore or waste rock hoisted is tipped into a small headgear bin from which it is led by conveyor either to an ore bin situated over the mine surface haulage railway line or to a waste bin whence it is taken by self-dumping skip to the waste dump.

A 15° three-compartment sub-incline shaft is now in the course of sinking in the Waterval area. This shaft will be equipped with two 10-ton skips. Ore and waste will be delivered to their respective passes at the top of the incline and trammed to the Waterval vertical shaft tips by overhead electric locomotive.

Generally, except in the eastern extension area, the haulage of ore underground is by overhead electric locomotives pulling trains of four-ton hoppers through footwall haulages. In the eastern extension area, two-ton diesel locomotives are in use.

Drilling a round of holes before blasting in a reef drive at Rustenburg

Stoping Practice

A great deal of thought and investigation has gone into the laying down of standard working methods to ensure the delivery of a product of the highest value to mill at the lowest cost. The regularity of the deposit has made the laying down of these standardized procedures comparatively simple, and has, to a large extent, eliminated the necessity of having to work round large blocks of unpayable ore. Regularity of dip and strike and freedom from faulting allow stope faces to be carried on a true dip line, which leads to optimum breaking.

The aim in stoping is to advance the face in as straight a line as possible on dip at the lowest possible stoping width compatible with efficient breaking. Shallow gully tracks on strike at 40 ft. centres on dip divide the working face into panels and serve as passageways to and from the face. The raise-winze connection becomes the path of the central gully scraper.

Ore broken on the face is first washed down and examined by the panel-cleaning native. All footwall norite and Merensky pyroxenite of sortable size is picked out and thrown back on to the face scatter-pile. The ore remaining is then shovelled 30 ft. down dip and 10 ft up dip to the panel track, where it is loaded into ½-ton cars, trammed along the gully track and tipped into the central gully scraper path. It is then scraped to the

Part of the flotation plant at Rustenburg. Eight banks of eighteen cells act as roughers, with a further two banks of eighteen cells as cleaners

stope box connecting the stope to foot-wall haulage, loaded into hopper trains and delivered to the shaft box or ore pass system.

Metallurgy of the Platinum Ores

The discovery of platinum in the Bushveld deposits in 1924 posed several problems for the metallurgists, as this was the first time that ores had been mined primarily for the production of platinum. Previously they had been recovered as alluvial platinum from placer deposits, or as a by-product from the mining of nickel-copper ores.

The ore first treated at Rustenburg was from the oxidized zone. It was soft and friable and was mined by pneumatic picks. A recovery plant was built and started operations in 1930. The ore was ground in ball mills, with great care to avoid sliming, the pulp went to the concentration section, consisting of James tables and corduroy tables, by means of which a rich gravity concentrate was made, and the pulp was finally sent to a flotation section to recover a concentrate.

The concentrates recovered by the gravity concentrate section were recon-centrated by dressing on James tables. By repeated dressing they were brought up to a suitable grade, which was sent overseas directly to the refiners.

As the mine progressed to deeper mining, the proportion of oxide ore milled decreased as operations got into the sulphide zone. Apart from other effects on the metallurgical treatment, the sulphide ore reduced the proportion of platinum group metals recovered in the gravity section. The question has often been discussed as to whether it is advantageous to carry on with the gravity recovery, or whether flotation alone should be relied upon. Apart, however, from the safety factor, that by taking out a rich fraction early in the treatment a slightly lower tailing may be obtained, there is a definite economic advantage in making this product. As the product is high in platinum metals it is sent directly to the refiners, thus avoiding the small but inevitable losses incurred in the further treatment of the flotation concentrates.

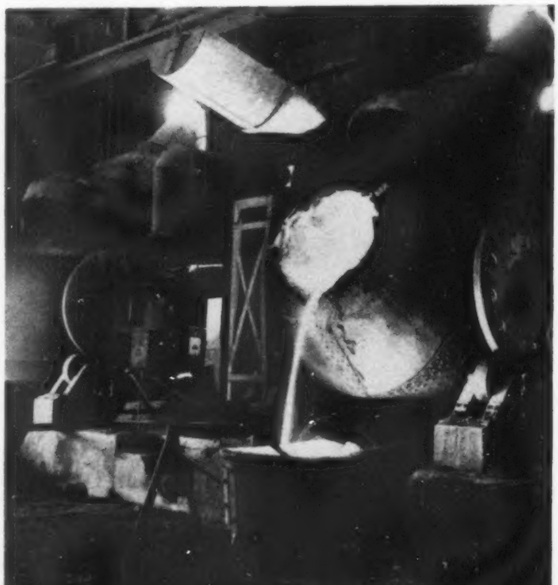
The gravity concentrates consist of sperrylite (platinum arsenide), cooperite (platinum sulphide), braggite (platinum palladium nickel sulphide), stibio palladinite (palladium antimonide), laurite (ruthenium sulphide), native platinum, native gold, mixed with chalcopyrite, pyrrhotite, pentlandite and other sulphides, with some chromite and graphite.

As a greater proportion of the platinum group metals was then recovered by flotation, the problem of the treatment of the flotation concentrate arose and there was much experimentation (and controversy) to discover the best method.

A number of methods were given intensive investigation, but the one that was most successful, and is now adopted, was to smelt to a nickel-copper matte. Preliminary work was carried out on this method by H. R. Adam at the Government Areas Laboratory, but it was Johnson, Matthey and Co. Limited who first successfully used the method on a large scale. That this method should be considered was, of course, obvious, as the concentrate contains nickel, iron and copper sulphides—all the requirements for a matte — but the high recovery of the platinum group metals in the matte was somewhat of a surprise.

The mill at Rustenburg is on the same site as the original 300 ton/day mill, and great care and ingenuity have had to be exercised to extend and modernize it to its present capacity.

The ore is first crushed in two jaw crushers, to reduce it to -6 in., the fines (-2 in.) are screened out and the



Pouring blown matte from one of the Great Falls converters. After cooling and breaking up the matte is shipped to Johnson Matthey for the extraction of copper, nickel and the platinum metals

coarse washed on vibrating screens and then passed over sorting belts. The coarse ore is then crushed in two Symons standard crushers; the crushed product from here goes to the ½ in. screens, with the oversize from the ½ in. screens returning to two Symons short-head crushers in closed circuit with these screens.

The washings go to four rake classifiers, the rake product being added to the mill feed product, the classifier overflow going direct to the mill circuit.

Ball milling is carried out in two stages—primary and secondary. There are a total of 22 mills, including the original four mills installed in 1932. The mills are in closed circuit with hydrocyclone classifiers, which give much sharper separations.

Gravity concentration is by means of corduroy tables, which so far have proved the best practical means of recovering the fine platinum minerals. The corduroy concentrate is dressed on an elaborate system of James tables up to a final concentrate which is sent directly to the refiners.

The tailings from the tables, in a considerably diluted pulp, are returned to the mill circuit, the final pulp from the mill being thickened to flotation density in four 75 ft. thickeners fitted with diaphragm pumps. The thickener underflow then goes to the flotation plant. The circuit used is a straightforward rougher-cleaner circuit, with the cleaner tailings returned to the head of the roughers. The thickener underflow is divided into two halves by a splitter in a launder, and each half is divided into four streams by revolving distributors. The eight streams are fed to eight banks of 18 cells acting as roughers. A further two banks of 18 cells act as cleaners.

The flotation tailings are sampled by an automatic sampler, thickened in a 250 ft. traction thickener and discharged to the tailings dam. The concentrates are filtered on three 8 ft. by 8 ft. drum filters before passing to the smelter. The small tonnage of concentrates to be smelted initially led inevitably to the use of a small blast furnace. As the tonnage to be smelted has increased considerably, thought has been given to the possible use of reverberatory furnaces, but it has been decided to retain the blast furnace for smelting. Among other reasons, the small blast furnace is very flexible—it can be stopped and started readily.

There are four blast furnaces, 10 ft. long by 36 in. at the tuyeres, the number in operation depending on the output required. The furnaces are water jacketed and run with a trapped spout into forehearths. Matte is tapped periodically into ladles and blown in three upright (or Great Falls type) 8 ft. converters. The blowing is carried as far as the white metal stage, and the white metal is poured into moulds. When solid this is broken up in a small jaw crusher, bagged and sent to the refiners. It contains about 74 per cent copper plus nickel. The converter slag is cast and returned with other secondary material to the blast furnaces. The blast furnace slag is run off continuously, and quenched in a launder with a strong stream of water. The granulated slag and water runs into a rake classifier (one for each furnace) and the slag granules are raked on to a conveyor belt which conveys them to a storage bin, from which the slag is carried to the dump.

The converter matte is treated at the Brimsdown works of Johnson, Matthey and Co. Limited by the "tops and bottoms" process. The matte is smelted with salt cake and the copper passes into the "tops" and the nickel into the "bottoms". The copper sulphide tops are blown to blister copper and cast into anodes for electrolytic refining. The nickel sulphide bottoms are ground and roasted to nickel oxide. This is reduced to metallic nickel with coal in a reverberatory furnace and cast into anodes for electrolytic refining. The anode slime from both the electrolytic sections contains the platinum metals and is then sent to the platinum refinery.

MEN and Metals

A recent appointment announced by Kaiser Aluminium Company Limited is that of **Mr. A. B. Hilliam,** who is taking up the position of regional sales manager for the Midlands area and will be responsible primarily for aluminium ingot and billet sales. He will be located in Birmingham.

Appointed chairman of Consolidated Zinc Proprietary, which is the overall management company for the Australian interests of the group, **Mr. M. A. Mawby** has also been appointed chairman of Interstate Oil. **Mr. M. I. Freeman** has been appointed chairman of Imperial Smelting Corporation.

After 26 years' service with The General Electric Company Limited, **Mr. J. P. Clifton,** A.C.G.I., A.M.I.E.E., manager, technical manuals department, at the Witton works of the company, has retired, but will continue to serve in a consultative capacity until the end of September next.

At present deputy managing director of Monsanto Chemicals, **Mr. John C. Garrels, Junr.,** is to become managing director in succession to **Mr. D. R. Mackie,** who is resigning from that position at the end of next month for health reasons. Mr. Mackie will remain a member of the board.

Two new appointments have been announced by Williams and Williams Limited. **Mr. J. F. Wilkinson** is to be the new general manager of Roften Works in succession to **Mr. E. B. T. Wright,** who has left to take up an appointment in the Far East. The second appointment is that of **Mr. L. A. L. Brown,** who is to be the deputy general manager (technical) at Roften.

Appointed assistant director of technical information for Climax Molybdenum Company, a division of American Metal Climax Inc., is **Mr. Barry Crowston.** As assistant to **Dr. J. Z. Briggs,** director of technical information, Mr. Crowston will work principally on the preparation of publications concerning molybdenum and its uses. Prior to his association with Climax, Mr. Crowston worked for four years as an apprentice metallurgist at the Appleby-Frodingham branch of United Steel Companies in Scunthorpe. Following this, he attended the University of Nottingham, receiving a B.Sc. in Metallurgy.

News from the Head Wrightson Export Company Limited is that **Mr. E. J. Robinson** has been appointed a director and that **Mr. R. F. N. Otway** has joined the company as manager, Europe.

A new Castrol appointment is that of **Mr. P. L. McIlmoyle,** M.A., A.R.I.C., who has been appointed assistant manager, purchasing department of Castrol Limited.

From the Brookside Metal Company Limited it is learned that **Mr. P. O. Jones** has been appointed deputy managing director of the company and that **Mr. P. Clowe, Mr. W. H. Crowdy** and **Mr. D. W. Hartnell** have been elected to the board.

On September 3, **Miss E. M. Allden,** managing director of The Plus Gas Company Limited, leaves by air for Johannesburg on a three weeks' tour of South Africa, the Rhodesias and Kenya.

Nickel Data

SUBJECTS covered in the current issue of *The Nickel Bulletin* include the physical properties and the determination of nickel and the low-temperature characteristics of nickel/cadmium batteries. Attention is directed to literature on the corrosion-resistance of nickel/chromium electrodeposits, double-layer-nickel plating processes, and industrial plating of screws and bolts.

In the section concerned with heat- and corrosion-resisting materials, attention is drawn to four compilations of published data on the physical and mechanical properties of representative nickel-containing high-temperature materials, to structural studies of nickel-base alloys, and to work on the corrosion behaviour of aluminium-nickel alloys.

REFINING LEAD

SURVEY OF METHODS FOR THE REMOVAL OF BISMUTH

By J. F. Holmes, A.I.M.

(*Concluded from* METAL INDUSTRY, 18 *August* 1961)

IN pilot-scale experiments on the removal of bismuth by electrolytic refining in a lead-sulphamate-sulphamic acid bath, the writer used anodes of unrefined secondary lead which had been made up to bismuth contents of 0·025-0·05 per cent and 0·08 per cent. Anode charges of between 5 and 8 cwt. were employed, and no difficulty was experienced in reducing the bismuth to 0·0005 per cent and 0·0009 per cent.

The method of preparation of the sulphamate bath is of interest; the method of forming a dry, readily soluble, free-flowing powder is given in the du Pont patent.[75] Litharge, solid dry sulphamic acid and ammonium sulphamate are mixed in the presence of traces, e.g. 0·5-2·0 per cent by weight, of water at a temperature of 105°-145°F. A reaction results between the litharge and ammonium sulphamate, evidenced by a change of colour from that of litharge to substantially white. Forty parts of litharge, 40 parts of sulphamic acid, and 20 parts of ammonium sulphamate are suggested, and it is stated that the *p*H should be less than 7·0 and preferably less than 4·2.

The correct choice of an addition agent is of prime importance in the sulphamate process of lead electrodeposition, to secure firm adherent deposits and to counteract the tendency to "treeing", with consequent short-circuits.

Piontelli and Fanganini[57] stated the bath yields deposits tending to be macrocrystalline and that the use of suitable additions is indispensable. Animal glue and fish glue, balsam, colligneol are in use. The San Gavino plant are quoted[76] as using 0·8-1·0 kg. colligneol (a concentrated solution of sulphitic residues from cellulose lyes), 0·7-0·8 kg phenol and 0·4-0·5 kg. animal glue per metric ton of refined lead, or 0·8-1·0 kg. colligneol and 0·2-0·3 kg. tannin per metric ton.

Mather and Forney[77] gave details of the effects of 193 different addition agents and combinations of these, and Mathers and Felgar[78] gave details of Hexanol 3-Tails, a complex mixture containing phenolic compounds with cresols and xylenols, and a method of keeping a solution of the addition agent in a heavy insoluble liquid in the bottom of the bath. This addition agent was found to be good with a fluosilicate bath.

Skrowronski[79] reviewed electrolytic refining methods in 1924, and Loshkarev and Mark[80] discussed the deposition of lead from baths containing 1·0 gm. equiv/L. of lead and 0·2 gm. equiv/L. of free acid from nitric, sulphamic, m-benzene disulphonic, p-phenolsulphonic and m-cresolsulphonic acid. Resorcinol, aloin and beta-naphthol with and without gelatine were used as addition agents. Dendritic growths were encountered with many of the baths but they obtained fine-grained deposits from p-phenolsulphonate m-benzenedisulphonate baths containing 1·0 gm/L. gelatine at 20°C. and with a current density of 200 amp/m^2 (18·58 amp/ft^2) provided pure acids were used.

The electrolytic refining of lead anodes which had previously been substantially freed from copper, tin, antimony and arsenic in an electrolyte of an aqueous alkali and a bivalent lead compound (e.g. caustic soda and lead monoxide) together with sufficient glycerine or ethylene glycol to increase the solubility of the lead compound, was patented in 1944 by Gueterbock and Baxter,[81] and electrolysis with a caustic soda electrolyte was the subject of a patent in 1950[82].

The use of an electrolyte of fused chlorides of lead or alkali or alkali earth metals at a temperature of around 500°C. for the electrolytic refining of lead containing bismuth and possibly silver was patented by Alabyshev[83] in 1945. The electrolysis of galena in an electrolyte of fused lead chloride at 500°-600°C. and with a current density from 500 amp/ft^2 with a 1 per cent solution of galena to 1,000 amp/ft^2 for a 10 per cent solution was tried at Halkyn, in North Wales.[84]

The theoretical fundamentals of electrorefining metals which represent the best methods available for obtaining the purest metals, and the effects of impurities on the properties of metals were discussed by Hansel.[85]

Other electrolytes for the electrodeposition of lead have been the subject of numerous patents and Papers, and include perchlorates, nitrates, oxalates, cyanides, plumbites, acetates, dithionates, pyrophosphates and p-toluenesulphonate.

These processes are not, as far as is known, used on a commercial scale for electrorefining, and accordingly only brief references are included.

The lead perchlorate $Pb(ClO)_4$ bath[86] contains 5 per cent of lead and 2-5 per cent of free perchloric acid with 0·05 per cent peptone.

The lead fluoborate bath[87] uses an electrolyte of 160 gm/L. of a 50 per cent solution of hydrofluoric acid, 74·4 gm/L. of boric acid, 129 gm/L. of basic lead carbonate and 0·1 gm/L. of glue.

Colegate[88] gave details of the preparation, composition, operating conditions and problems, and the analysis of lead fluoborate solutions, with a brief description of fluosilicate and perchlorate baths and electrolytes containing litharge and caustic soda for electrodeposited coatings rather than for electrorefining.

Bateman and Mathers[89] discussed the deposition of lead from lead dithionate baths. The bath is used in 4 per cent solution containing dithionic acid and gives good cathode deposits but is somewhat unstable.

The use of p-toluene sulphonate baths was covered in a Paper by Mathers and Garess[90] with particular reference to addition agents to secure satisfactory deposits. It was stated that if p-toluene sulphonate could be produced cheaply enough it may replace fluosilicic acid in lead refining.

Vard and Rama Char[91] described the use of pyrophosphate baths for the electrodeposition of lead.

The use of electrolytes containing the sulphones of phenol, cresol, resorcinol or naphthol was the subject of patents in 1943.[92,93]

The du Pont sulphamate lead-plating process[75] for the production of lead platings of fine-grained, adherent deposits, uses an anthraquinone sulphonate addition with a sulphamate bath. A description of the process was given by Schweikher.[94] An electrolyte of lead sulphamate is employed, having a *p*H of 1·5, and a temperature of 75°-120°F. A current density of 5-40 amp. is used. The patent covers the use of anthraquinone sulphonate with other baths, such as the acetate.

Recovery from Drosses

There are various methods of recovering bismuth from the bismuth dross of the Kroll-Betterton process, which normally contains approximately 20 per cent bismuth and 2-3 per cent each of calcium and magnesium[95] together with any arsenic or antimony which were present in the metal.

A liquation under a cover of alkali-

earth chlorides with small amounts of sodium chloride, will enable some 75 per cent of the lead to be separated, containing only a small amount of bismuth.[96]

The bismuth is thus concentrated to approximately 50 per cent with 5 per cent each of calcium and magnesium and 35 per cent of lead. This is treated with lead chloride or with chlorine, to remove the calcium and magnesium, after which, if silver is present, desilvering treatment is given. Further chlorination then removes all the lead as lead chloride, which is re-used in the process.

Powell[97] considered the best method of treatment for drosses with less than 30 per cent of bismuth, was to concentrate the bismuth to 35-40 per cent, oxidizing the lead by cupellation or blowing hot air through the molten metal.[98]

Very little bismuth passes into the litharge, until a concentration of 50 per cent is reached. The bismuth can be further concentrated by stirring in bismuth sulphide at a dull red heat. The bismuth sulphide is reduced to bismuth, and lead sulphide is formed.

At Perth Amboy, the rich bismuth crust is melted with lead chloride, and the calcium chloride and magnesium chloride skimmed off. The lead, which contains some 20 per cent bismuth, is given a chlorine treatment at 540°C. for a short time, and then desilvered by the Parke's process, and a further chlorine treatment given to convert the remaining lead to lead chloride and leave 99 per cent bismuth metal.

Recovery from Anode Slimes

The treatment of anode slimes was covered by Bett's patents in 1908 and 1909.[99]

The following methods of treating anode slimes have been described:

(1) The removal of arsenic, selenium and sulphur by roasting, leaching with a dilute sulphuric acid solution to remove copper, and precipitating any bismuth from solution with copper oxide. The insoluble residue is then smelted with lead and the bismuth-rich bullion concentrated as described above.

(2) The dried slimes can be fused with caustic soda and sodium carbonate and with sodium sulphide if copper is present. An oxidizing fusion gives the slag or dross containing the lead, antimony and arsenic. A second oxidizing fusion then oxidizes the bismuth and remaining base metals, leaving the precious metals. The slag from the second fusion is fused with salt cake and carbon to give an impure bismuth, which can be refined electrolytically, and matte and slag containing the other metals.[100]

(3) For the electrolytic refining of anode slimes, the dried slimes are fused with caustic soda and sodium carbonate as at (2) above and are then cast into anodes and electrolyzed. An acid solution of bismuth chloride is used as electrolyte at a current density of 15-30 amp/ft^2 and a tank voltage of 0·5-1·0 V, using cathodes of graphite or pure bismuth.

The Consolidated Mining and Smelting Co., of Canada, patented a process in which a single-stage oxidation process is continued to give the bismuth in a litharge slag, yielding a lead-bismuth alloy on reduction. Copper is removed by drossing, and precious metals by the Parke's process. A Pattinson process of crystallization then gives a bismuth-lead eutectic with a melting point of 125°C. This eutectic can be treated as above or electrolyzed by the Bett's process to give lead and a bismuth-rich anode slime for melting and refining.[101-103]

Cerro de Pasco uses fire-refining methods for the recovery of the metals from anode slimes which contain 19-20 per cent lead, 0·8 per cent copper, 12-13 per cent arsenic, 23-24 per cent antimony, 30-31 per cent bismuth, with 280 oz. of silver per ton.

The lead, antimony and arsenic are separated as an oxide slag by controlled oxidation in a small reverberatory furnace. The remaining bismuth, copper and precious metals are transferred to a converter and oxidized until the base metals are removed as molten oxides. The silver and gold are cast into doré anodes for parting by electrolysis.

The lead antimonial slag is reduced to antimonial lead, and the oxide slag of bismuth and copper crushed with salt-cake and coke and smelted to impure bismuth, which is then cast into bars for refining.[52]

Bismuth removal in a large refinery where the main lead production requires debismuthizing thus presents a different problem to the case of a refinery in which it is only occasionally necessary to reduce the bismuth content of lead to comply with a particular specification. In each case, careful consideration of the relative merits of the different processes is called for as regards capital cost, operating costs, labour and space requirements.

References

75 British Patent 570,287.
76 *Lead News*, 1959, **11**, (8), 4.
77 F. C. Mathers and R. B. Forney; *Trans. Electrochem. Soc.*, 1939, **76**, 371.
78 F. C. Mathers and Felgar; *Trans. Electrochem. Soc.*, 1946, **90**, 81.
79 S. Skowronski; *Trans. Amer. Electrochem. Soc.*, 45, Preprint 1924.
80 M. Loshkarev and I. Mark; *Zhur. Priklad. Khim.*, 1948, **21**, (6), 589.
81 U.S. Patent 2352625, 1944.
82 U.S. Patent 2507096, 1950.
83 U.S.S.R. Patent 65015, 1945.
84 Butcher; *Met. Ind.*, 1937, **50**, 106.
85 G. Hansel; *Elektrochem. Zeitung.*, 1943, **64**, 579.
86 *Trans. Amer. Electrochem. Soc.*, 1913, **23**, 159.
87 "The Fluoborate Bath", *Trans. Amer. Electrochem. Soc.*, 1926, **36**, 248.
88 G. T. Colegate; *Ind. Finishing*, 1936, **136**, 138.
89 R. C. Bateman and F. C. Mathers; *Trans. Electrochem. Soc.*, 1933, **64**, 283; Discussion (*ibid*), 291.
90 F. C. Mathers and J. C. Garess, Jr.; *J. Electrochem. Soc.*, 1948, **94**, (5), 46N.
91 J. Vard and T. L. Rama Char; *J. Electrochem. Soc.*, 1957, **104**, (7), 460.
92 U.S. Patent 2313371, 1943.
93 U.S. Patent 2313372, 1943.
94 E. W. Schweikher; Thirtieth Annual Convention Amer. Electroplaters' Soc., 1942, 90.
95 J. G. Betterton and Y. E. Lebedeff; *Trans. A.I.M.E.*, 1936, **121**, 205.
96 U.S. Patent 1989734.
97 A. Powell; Refining of Non-Ferrous Metals Symposium, Inst. of Metals, London, July, 1949.
98 U.S. Patent 1870470.
99 A. G. Betts; "Lead Refining by Electrolysis" J. Wiley, New York, 1908.
100 C. R. Hayward; "An Outline of Metallurgical Practice" Van Nostrand, New York, 1952.
101 U.S. Patent 1967053.
102 U.S. Patent 1801339, 1931.
103 P. F. McIntyre; *Trans. A.I.M.E.*, 1936, **121**, 271.

Analytical Standards

RECENT additions to the range of the chemical and spectrographic standard samples supplied by the Bureau of Analysed Samples Limited include the following:

B.C.S. No. 300: 6 per cent zinc-aluminium alloy analysed for copper, manganese, silicon, magnesium, iron, titanium, chromium and zinc.

B.C.S. No. 304: 10 per cent aluminium bronze analysed for copper, zinc, nickel, iron, manganese, silicon and aluminium.

B.C.S. No. 305: 75 per cent ferro-silicon analysed for phosphorus, aluminium, calcium and silicon.

B.C.S. No. 306: 0·4 per cent carbon free-cutting steel analysed for silicon, sulphur, phosphorus, manganese and carbon.

The above are only available in finely divided form for chemical analysis.

S.S. Nos. 21-24. A series of low tungsten steels standardized for tungsten only with tungsten contents ranging from 0·7 per cent to 3·4 per cent.

This series is supplied in the form of ¾ in. diameter rods each 3 in. long for use as spectrographic standards, but is also available in the form of turnings for chemical analysis bearing the reference numbers B.C.S. 281-284.

These samples are obtainable from the Bureau of Analysed Samples Ltd., Newham Hall, Middlesbrough.

OUT OF THE MELTING POT

Easier Determination

LIKE so many other things, the heats of sublimation of metals and alloys must be subject to the law of supply and demand. Judging by the paucity of published data, and from experience, the demand is small. This should not, however, discourage any investigator who might be planning an extensive series of determinations of this particular property of metals and alloys, either for the good and sufficient reason that it is there to be determined or for the sake of the light the results might shed on various metallurgical problems. In the course of the literature survey which any such investigator would, of course, carry out before starting on his work to discover what methods have been used to measure heats of sublimation of metals and what results have been obtained, he would now meet a convenient recently developed electrical method. The method involves the evaporation of the specimen by passing through it a sufficiently high electric current pulse, and is based on the use of the current pause phenomenon which occurs in pulse heating, when the energy supplied to the specimen is just equal to or greater than that required to evaporate it. On the supply side, the apparatus consists of a current pulse generator comprising a 25 kV rectifier, an energy storage unit in the form of an assembly of equal lengths of coaxial cables connected in parallel and an electrostatic voltmeter. The test-specimen is mounted in an airtight chamber in series with an adjustable air discharge gap. On the measuring side, means are provided for recording the variations in voltage and current across the specimen with a double-beam oscillograph. Given a sufficiently powerful pulse, a typical oscillogram will show an initial increase in current followed by a drop to a steady value, the beginning of which (the current pause) corresponds to a sharp peak on the voltage trace. The accuracy of the results obtained is about 5 per cent, but could be increased to 1-2 per cent. The method has already been used to determine the heats of sublimation of a number of metals and alloys including a series of lead-tin alloys with from 0 to 100 per cent tin. Like so many other properties, the heat of sublimation could be used as a means of determining constitutional diagrams of alloy systems.

Lubricants

AMONG recently developed lubricants that depart more or less from the conventional concept of such materials is a lubricating coating composition intended for application to metal sheet to be formed by deep drawing, spinning or impact extrusion. The presence of this coating on the sheet avoids the need for lubricating the press tools or other forming means or, of course, the sheet itself. It also permits the number of annealing operations to be reduced, and decreases defects such as scoring and splitting. It also greatly prolongs the life of the tools before they have to be repolished. The coating composition comprises a solution in trichloroethylene of a copolymer obtained by polymerizing 88 parts of *n*-butyl methacrylate, 10 parts of methyl methacrylate and 2 parts of methacrylic acid, a proportion of mineral oil also being added to the solution. Another "lubricant", differing still more from the conventional, has been suggested for use in the deep drawing of sheet metal. It takes the form of a thin film of polyvinylchloride which is placed loosely over the sheet metal blank. In addition to acting as an excellent lubricant in the drawing operation, the film also provides an effective protection for the metal against scratches and other tool marks. Compared with conventional lubricants, varnish or phosphate coatings, it has the advantage of being very easy to apply and, what is even more important, very easy to remove from the drawn product.

Relevant

NOT nearly enough publicity has been given in metallurgical circles to the pronouncements by Dr. J. S. Anderson, director of the National Chemical Laboratory, at the recent International Symposium on Inorganic Polymers. And yet, these pronouncements should bring some relief to metallurgists harassed by nightmares that one dreadful day all their endeavours in the direction of strong heat-resistant alloys will be set to nought by the appearance of a non-brittle, oxidation-resistant inorganic polymer, of low density, with a melting point well above 1,000°C. and having a strength which, like that of graphite, for example, quite perversely increases with temperature. At the same time, however, Dr. Anderson's observations are not without morals that could be drawn and noted by those self-same metallurgists fearful for the future of their complex super-alloys. To begin with, the consolation can be derived from the conclusion that the rapidly growing research effort on inorganic polymer systems has yet to point to any clear-cut route. Nor, it appears, has the effort yielded any outstanding products that are ripe for commercialization. The moral, on the other hand, is to be drawn from the remark that one problem in research on inorganic polymers is the heavy emphasis, both governmental and commercial, on getting usable materials that resist high temperatures. The result is that the chemists tend to concentrate on preparative chemistry, to the relative detriment of the basic research needed to back up synthetic work. Is it necessary to add that, to point the moral, alloys, metallurgists, etc., should be substituted where required. Of broader interest is the observation that whereas, as in the case of organic polymers, the physical properties of an inorganic polymer will depend on the entire structure, the chemical properties are likely to be determined by the local pattern of bonds. Whereas much is known about the structure of inorganic systems, much more remains to be learnt about the reactions by which they are formed or are converted into one another, with a view to determining why polynuclear complex compounds are not formed more often in various reactions that might be expected to lead to such compounds.

Skimmer

Reviews of the Month

NEW BOOKS AND THEIR AUTHORS

CABLE SHEATHING

"Lead and Lead Alloys for Cable Sheathing." *By S. A. Hiscock. Published by Ernest Benn Ltd., Bouverie House, Fleet Street, London, E.C.4,* 1961. *Pp.* 361. *Price* £3 10*s.* 0*d.*

ONE of a series written in the interests of advancing the art and science of cable manufacture and usage, this is the first work devoted exclusively to the subject of lead cable sheathing.

In his preface, the author says: "It is, perhaps, surprising that more attention has not (hitherto) been paid to the production and properties of lead cable sheaths in view of their importance both to the electrical and, as an outlet for lead, metallurgical industries.

Unfortunately, this excellent book, like so many books on technological subjects, because of its price will not get into the hands of those operating the machines.

The contents of this book could very well be sub-divided into specialized parts and published separately in cheap paper-backs at a price which would make them available to the lesser paid workers in the industry manufacturing cable sheathing. Such paper-backs are available in West and East Germany and in the U.S.S.R., their sales evidently offering advantages to the publishing houses and all concerned with industrial economy.

The book ably describes the production, properties, technology and applications of lead cable sheathing: it is one that this reviewer can recommend.

D. Ll.

HYDROGEN DETERMINATION

"Spectral-Isotopic Method for the Determination of Hydrogen in Metals." *By A. N. Zaidel, A. N. Petrov and G. V. Veinberg. Translated by A. Behr. Edited by G. E. Gardam. Published by Butterworth & Co. (Publishers) Ltd., 88 Kingsway, London, W.C.2. Pp. xix + 100. Price 30s.*

THIS small book with a rather formidable title is a translation from the Russian and is published in association with the Department of Scientific and Industrial Research. It describes recent work carried out in Moscow by Zaidel and his collaborators on a new procedure for the determination of hydrogen in metals, stemming from his original suggestion in 1950 that use could be made of isotope balancing, followed by spectroscopic analysis of the equilibrated gas phase, for this type of measurement. A series of eight Papers by these authors has appeared since 1955, and a complete account of the experimental procedure and the results they have obtained is presented in this volume.

The translation would appear to be excellent. Only one or two trivial inaccuracies have been noted but the reviewer feels constrained to comment on one point which is not perhaps peculiar to this book, but is rather a general illustration of how the multiple recording of work can make life even more confusing in these already overcrowded days. Thus Smithells, Barrer and Dushman have in their time all written valuable textbooks bearing on the theme under review. Apparently, these have been reprinted in Russian, and the bibliography in the present book refers only to these Russian editions, which are several years later than the original ones; in addition, the authors, after undergoing the double metamorphosis, English - Russian - English, finally reappear on the right side of the curtain as Smittels, Berrer and Deshman respectively.

The contents of the book are readily summarized. There is an introductory section on the interaction of hydrogen with metals which is perhaps adequate for its purpose, but has a distinctly old-fashioned air about it. This is followed by a brief discussion of the principal features of isotopic balancing —in this context, the exchange to equilibrium of the hydrogen present in a metal sample with a deuterium atmosphere which is brought into contact with it under appropriate conditions. The H/D ratio in the gas is then determined by spectrographic analysis, and there is a useful section in the book which describes this procedure and then assesses the main sources of error. Subsequent sections are devoted to a general description of the complete apparatus and of the special conditions which have been found suitable for determinations on various metals; all the experimental directions are given in rather surprising detail. The authors give specific procedures for zinc, cadmium, aluminium, nickel-chromium alloys, iron and steel, titanium, tantalum, niobium and uranium, and typical results on these metals are quoted. In some cases, the hydrogen contents determined by the isotope method appear to be in good agreement with those obtained by more orthodox techniques, e.g., hot extraction, but there is one notable exception in aluminium. Here the values are almost an order higher than would be expected by classical analysis; one possibility is that the conditioning of the apparatus recommended by the authors is not adequate for highly-reactive metals with a low hydrogen content.

Because this present book is from the Russian, it cannot fail to be interesting, if only for a comparison of techniques. However, the reviewer now comes to an ethically difficult part of this review —whether to inflict on the reader his own personal views on the principle of the method to which the book is devoted? To do so may merely serve to confirm the opinion of some that (in Hazlitt's phrase) "the slenderness of his pretensions to philosophical enquiry is accompanied with the most presumptuous dogmatism". Taking the plunge, however, it can be said that while there is clearly every justification for the use of isotopes in the elucidation of gas-reaction mechanisms (as evidenced, for example, in the admirable early work of Farkas in this field), its value in equilibrium measurements of the type indicated for analytical work is much less obvious. There was some useful discussion on this point at the Symposium on "The Determination of Gases in Metals", organized by the Society for Analytical Chemistry in conjunction with the Iron and Steel Institute and The Institute of Metals, which was held in May last year, and reference might perhaps be made to the record of this meeting when reading the present book—for it certainly should be read by all those interested in gas-metal problems.

C. E. R.

METALLURGY OF ROLLING

"The Physical Metallurgy of Rolling." *By F. H. Scott. Published by Arthur H. Stockwell Ltd., Elms Court, Ilfracombe, Devon. Pp. vii + 94. Price* 10*s.* 6*d.*

THE title of this book is, I think, misleading since, in reality, it deals with the physics and metallurgy of rolled materials as well as the mechanics of rolling. To one who wishes to know about the engineering aspects of rolling — and the picture on the jacket encourages this hope — there is little to be gained in buying the book. For example, in Chapter 2, the only useful reference to the rolling mill is one page descriptions of the angle of contact, the coefficient of friction and the problem of rolling thin materials, the treatment of this item being quite inadequate.

In Chapter 3, torque, the force developed during rolling, spread and metal flow are dealt with in an elementary style, the latter item, curiously enough, being illustrated by a photograph showing etched rivets clamping structional members together, this being one of the only four plates contained in the book. Chapter 5 contains a full mathematical treatment of Orowan's theory of rolling. However, here, a brief sketch would have been much more appropriate, the space saved being more profitably filled by a description of the work of Ford and others. As it is, there is practically only a mere mention of their names.

The 6th chapter is entitled "New

Approaches", but it is difficult to appreciate why the word "New" is employed. For instance, the eight small pages forming this chapter deal with front and back tension, speed, temperature during rolling, roll deflections—including a formula which is incorrect—roll flattening and multi-roll mills, by which is meant the old cluster mill and the quite common three-high mill, the description of these latter items occupying about one and a half pages. Chapter 7 — the last — only takes up three pages, carrying the title "The Theory of Rolling for Apprentices". It deals with a simple method of calculating rolling load, developed by Orowan and Pascoe in 1946 for hot thick strip rolling mills. However, the author does not mention this fact in any of these last three pages, and it is hoped that the "apprentice" does not apply it for computing rolling loads relating to the cold rolling of strip.

Regarding the physical/metallurgical aspects of the book, the procedure is to divide the chapters into small paragraphs each explaining the meaning of a physical or metallurgical term. Since the book is quite small and the number of terms covered quite large—e.g., they range from dislocations, gases in metals, anisotropy, fatigue, creep (which is accompanied by a creep curve for what is described as a "cadmium object"), the Bauschinger effect, etc.—it will be appreciated that the treatment of any one item is quite brief.

Finally, it can hardly be claimed that the bibliography of nine items will be useful to the "people from all walks of life where elementary technology is an everyday matter"—these being another group of readers for whom the author has prepared his book. Also, it should be noted that, with one curious exception, no reference whatsoever is made throughout the book to the original source of the publication of other people's work to which the author occasionally refers. **E. C. L.**

FORGING STEEL

"Cold Forging of Steel." *By Dr. Ing. H. D. Feldman. Published by Hutchinson & Co. (Publishers) Ltd., 178-202 Great Portland Street, London, W.1. Pp. 268. Price 40s.*

COLD forging has been with us for most of this century. The cold forging of steel has developed since about 1940. In this country it has threatened to replace some hot stamping and forging processes during the last five or six years.

Dr. Feldman's book, which might have been more aptly titled an introduction to the subject, treats principally of cold shaping, which is basically extrusion. This is, of course, the most widely known and used process, but one suspects that the author has omitted much recent experience in the field of solid cold shapes. There is also a marked sketchiness in his description of steel qualities and properties desirable for the process. Likewise, the properties of cold forged steel in relation to those of hot forged and treated steel are neglected. The notch-impact strength of cold shaped steel is illustrated by one small series of tests on one quality only of mild steel. An appendix gives the flow characteristics of typical steels, including mild alloy qualities which may well be perfectly clear to an experienced extruder but will not be too helpful to the student who wishes to marry this information with the chapter on the theory of cold extrusion. The book has a detailed Contents, but this does not compensate for the absence of an index.

The practical extruder should be enlightened by the chapter on fundamental theory and the section on industrial application is most comprehensive, as is the chapter on tools, but tool heat-treatment data may well confuse. Information on surface treatment of work to be extruded is most lucid and practical, which cannot be said of the very short consideration of economic factors. Here, there is no critical assessment of cold forming compared with machining or hot shaping.

The chapter on cold forging machines is wrought with authority and a comprehensive series of photographs of sectioned finished parts, clearly described, cannot help but indicate the scope of the process. Unfortunately, dimensions are lacking in many of the line illustrations and it may be found irksome to convert the (presumably) millimetre sizings where they are presented.

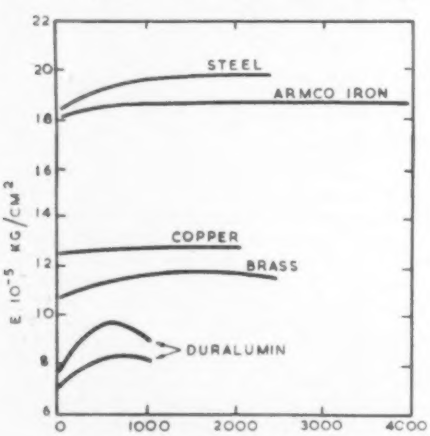
A. L. H.

High Pressure Elasticity of Metals

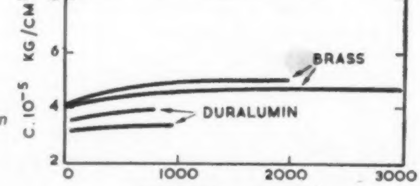
STUDIES of the effects of high pressure on metals have been made mainly from the point of view of the plastic flow involved in metal working processes.[1,2] Less work has been carried out on the influence of high pressures on the elastic properties of metals; the dynamic methods used in previous investigations[3,4] have shown increases in the moduli of elasticity of aluminium, copper and Armco iron with pressures up to 4,000 kg/cm^2. Recent Russian work[5] has been concerned with static methods of measuring the elastic properties under high pressures, and a brief description of the results obtained is given below.

The modulus of elasticity was measured on a simple beam specimen, stress being measured by strain gauges and deflection by an electrical method, and the relation between them giving the Young's modulus. A torsion test specimen was used to give the modulus of rigidity, the torque and angle of twist of the specimen being measured by strain gauges. Both series of tests were carried out in a high pressure chamber in a nitrogen atmosphere, and specimens of Armco iron, steel, brass, Duralumin and copper were tested over a wide range of pressures.

The relationship between the elastic constants and the pressure is shown



Left: Fig. 1—Relationship between Young's modulus and pressure



Right: Fig. 2—Relationship between modulus of rigidity and pressure

in Figs. 1 and 2. The modulus of elasticity at a pressure of 1,000 kg/cm^2 is 4-8 per cent higher than at atmospheric pressure, except for copper, where the increase is only 1 per cent. For Duralumin, there is, at first a rapid increase of up to 20-25 per cent, followed by a decrease. For the shear modulus, the values remain practically constant, but there is a slight increase for brass and Duralumin. It should be noted that the results obtained for Duralumin on different test specimens differ widely from one another.

It is clear from the above that the changes which occur in the elastic properties at high pressures do not compare with the changes associated with plastic flow of materials. They may be important, however, in the design of equipment which operates under high pressure conditions, particularly when the tolerances involved are extremely small.

References

[1] P. W. Bridgeman; "Large Plastic Deformation and Fracture". (Macmillan) (1955).

[2] B. Crossland; *Proc. Inst. Mech. Eng.*, 1954, **168,** 40.

[3] D. Lazarus; *Phys. Rev.*, 1949, **79,** 4.

[4] D. S. Hughes, C. Manoette; *J. App. Physics*, 1956, **27,** 10.

[5] Z. I. Stakhovskaya, L. S. Tomashevskaya; *Fiz. Metallov i Metallovedenie*, 1960, **9,** 4, 103.

Continuous Inspection of Rolled Strip

WITH increased speeds of sheet and strip production, the problem of adequate inspection becomes more acute. In many instances the point has been reached where human visual inspection cannot keep pace with the high line speeds. To overcome this problem and meet the more exacting demands of high speed inspection, the British Iron and Steel Research Association has developed three types of equipment for automatic in-line inspection. They are the ultrasonic lamination detector, the multichannel photoelectric scanner, and the arrested image TV apparatus.

The first of these consists of a probe mounted on rollers and placed on the surface of the strip near one edge. The probe contains a transmitter which sends pulses into the strip, and a receiver which picks up echoes from any defects and also from the far edge of the strip. Whenever the amplitude of an echo from a defect exceeds a preset level, alarm or control signals come into action. Acoustic coupling between probe and strip is maintained by a film of liquid (e.g. oil or water) applied through the probe. Reliable operation of the instrument requires that the strip be clean and dry and that it runs smoothly on a reasonably steady pass line to avoid bouncing of the probe. It is better to inspect strip before cutting into sheet, but the instrument is also applicable to discrete sheets on a conveyor or roller table. In this case the raising and lowering of the probe at the end of one sheet and the beginning of the next are carried out automatically under the control of photocells.

The signal level at which the accept/reject decision is made may be set and checked periodically by measurements on "standard" sheets, or in terms of a given fraction of the back echo. For example, it may be found on a particular product that the customer's specification is just met by setting the reject level at "1 per cent of the back echo". Working always to this level will ensure constant inspection criteria and hence a uniform quality of product.

The sensitivity of the instrument is such that it will detect, without ambiguity, a lamination 0·05 in. wide by 2 in. long in sheet 0·040 in. thick by 40 in. wide.

Sheets of thicknesses ranging from 0·026 in. to 0·050 in. have been inspected successfully in a steelworks, at speeds up to 80 ft/min. Extensions of the thickness range both up and down (e.g. up to 0·13 in. and down to 0·010 in.), and of maximum operating speeds to 600 ft/min. or more, are being investigated.

The multichannel photoelectric scanner was developed to study the feasibility of fully-automatic high-speed inspection for surface defects and blemishes during the manufacture of electrolytic tinplate and cold rolled strip.

The apparatus consists of two rows of photocells and a linear light source, an image of which is projected on to the surface of the tinplate. A system of lenses and defining apertures ensures that each photocell views an illuminated area of 0·1 in. in direction of travel by 1·2 in. width. The photocells are arranged to receive scattered (i.e. off-specular) light from the tinplate surface, and their output current increases when defects traverse the illuminated field.

The signals from the photocells are amplified and passed through biased discriminators which are set to a level slightly higher than the signal received from prime quality tinplate. Signals in excess of the discriminator level from all channels are summated and filtered by a resistance-capacitance network before being presented to a further discriminator which makes an "accept/reject" decision. The purpose of the filter is to equalize the amplitude of signals from localized (e.g. scratch marks) and extended defects of comparable severity.

The signals from individual channels as well as summated and filtered signals are shown on a cathode ray oscilloscope screen. The "accept/reject" discriminator operates an indicator lamp and the level at which the accept/reject decision is taken may be altered according to the required severity of the inspection.

In the third method of in-line inspection developed by the British Iron and Steel Research Association, visual inspection of tinplate travelling at high speed is carried out by equipment incorporating closed-circuit television.

A television camera views the tinplate via a mirror, which is rotated in order to neutralize the motion of the tinplate, the view of the tinplate being restricted to a narrow slot. The speed of the rotating mirror is adjusted to make this slot appear to move rapidly along a stationary sheet of tinplate. A long persistence or storage type of television display is used so that the successive views of the slot as it passes along the tinplate merge into a complete stationary picture of the tinplate sample inspected. This picture is thus presented to the inspector for a length of time adequate to assess the sample. Defects in the tinplate are revealed by the light which they scatter, and show up as bright areas against a dark background.

Standard Specification

Zinc Coatings on Iron and Steel Articles (*B.S.*729:1961). *Part 1—Hot Dip Galvanized Coatings* (*Price* 4*s*.). *Part 2—Sherardized Coatings* (*Price* 3*s*.).

THE revised edition of B.S.729 has been divided into two parts to cover hot dip galvanized coatings and sherardized coatings respectively.

The earlier standard specified visual examination and Preece copper sulphate dip continuity test for coatings. The revised standard introduces requirements, in Part 1, for weight of coating as well, giving three alternative methods of determination. Guidance is given on threaded work and an accepted procedure indicated.

In Part 2, visual examination and the copper sulphate dip test are alone specified. Again, recommendations for threaded work are included.

Copies of the above-mentioned standards may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Cerium

DISCOVERY AND ISOLATION

By M. Schofield, M.A., B.Sc., F.R.I.C.

JUST 50 years ago A. Hirsch prepared, after three years' effort, pure cerium by electrolysis of the fused chloride, the product being purified by amalgamation with mercury and distilling off the latter. In a second Paper in the same year, Hirsch described the preparation of pure cerium chloride, the anhydrous salt proving difficult to obtain until Hirsch's use of ammonium chloride to depress the hydrolysis of the cerium salt. The first true extraction of the free metal proved a decisive point in the history of cerium, providing as it did not only the answer to the difficult problem of separating a rare earth element, but also the unalloyed metal for research on properties and possible applications in industry.

Named after the planet Ceres and discovered at the beginning of last century, cerium first attracted attention as an unknown earth in a mineral (cerite) in the Bastnäs mine in Sweden, this mine being perpetuated within recent years by naming new deposits in California and Mexico "bastnasite". Klaproth, Hisinger and Berzelius were first in studying this rare earth with an unknown element for which Klaproth tried in vain to substitute the ungainly name "cererium". In contrast to his renaming beryllium and titanium, Klaproth was overruled; for the new earth really came when Berzelius and Hisinger were searching for yttria and found ceria instead. Gahn, that Swedish mineralogist who always carried his blowpipe in his pocket, and Vauquelin tried in vain to extract the free metal, as did Mosander, discoverer of lanthana and didymia. An impure laboratory specimen resulted from the normal practice in which a metal chloride was reduced with potassium or sodium, Mosander using potassium vapour, washing the residue with alcohol, and obtaining a brown powder which showed a metallic lustre when burnished. This was a very impure form of cerium with oxychloride contamination, the latter due to hydrolysis of cerium chloride—a problem later circumvented when ammonium chloride was used by Welsbach and others in making a purer salt. Other chemists like Wöhler, Hillebrand and Norton also prepared impure cerium, electrolysis superseding reduction by alkali metals.

Meanwhile, the preparation of cerium alloys had developed to the industrial scale, with Misch metal and pyrophoric alloys coming from von Welsbach's years of endeavour. Welsbach, after training under Bunsen in the use of the spectroscope, had collected rare earth specimens, and had begun his brilliant work by separating, in 1885, didymia into praseodymia and neodymia. Yet after noting how cotton threads soaked in his salt solutions not only gave spectra but continuous glowing in the burner flame, Welsbach turned to the problem of making a practical incandescent gas-mantle. He prepared fabrics of suitable shape, tried asbestos thread impregnated with rare earth salts, and, in collaboration with Haitinger, came first to use thoria and then to find cerium as a key element. To circumvent the fall in emissivity of his rough gas-mantles after 60 hr. burning, Welsbach was not only developing an industry but adding from the practical side to the pure chemistry of rare earths. He adopted 99 per cent thoria and one per cent ceria as final mixture for gas mantles, and outbid many rival manufacturers who claimed new elements like Lucium, Russium, Kosmium and Neokosmium in their specifications. Then came Welsbach's second success with cerium, this when he was concerned to find manufacturers having dumps of rare earth residues lying about factory yards, the custom being to give away 1 lb. of cerium residues with every 100 lb. of thorium salts purchased. He studied cerium alloys derived from reduction of mixed rare earths, and found one which gave a shower of sparks which would ignite gas. He had used uranium scratched on hard steel, yet discovered a cerium alloy with 30 per cent iron, and later 35 per cent, which served the purpose better for automatic gaslighters (and later the universal cigarette lighter). He alloyed his "mischmetall" of mixed rare earth metals with iron, tried cobalt, nickel and manganese, but finally specified his "Auer metal", selling his initial patent rights for £30,000 to German firms. Welsbach became President of a chemical works with 4,000 employees, a member of Vienna, Berlin and Stockholm academies of science, and was created a baron. His mischmetal theme was developed with 60 per cent cerium and 40 per cent iron for normal "flints", but for safety-lamps, bars of pyrophoric alloy are of less than 15 per cent iron, hardness being increased by bismuth or antimony. A French patent of 1909 (No. 405021) specified Kunheim metal from hydrides of rare earth metals plus some magnesium and aluminium. Other Auer metals on the British market came from impure German rare earths, imported; home-produced bars were later produced.

The free metal cerium has not developed to a comparable extent in the 50 years during which it became listed as a steel-grey metal tarnishing in moist air, evolving hydrogen with water, and burning more intensely than magnesium when heated. Mining of new ore concentrations, not only of Idaho monazite but of bastnasite, staved off the threat of scarcity in supplies, the new Mexican bastnasite, containing 28·6 per cent Ce_2O_3, which is more than double that of Californian ore. By 1950 cerium metal was selling at 12 dollars a lb. while mischmetal sold at 4½ dollars. To meet any new demands for pure metal there was a continual aim to improve reduction or electrolysis technique. Calcium was tried after alkali metal reduction, while high-purity cerium came from electrolysis of a fused bath of chloride using molybdenum cathodes, with which cerium does not alloy, or from cerium fluoride into which the oxide is fed. Reduction processes returned to cerium production when lithium metal served to reduce cerium fluoride in tantalum crucibles within a steel "bomb" at 1,150°C. Cerium alloys in the ferrous and non-ferrous field have been developed following German practice in which mischmetal was used in aircraft engine parts to increase stability at high temperatures. As for the pure metal, it still awaits wider use than as "getter" in electronic tubes and neon lamps, or in catalysis.

Purifying Argon

ARGON is the cheapest inert gas, but the impurity levels ($\sim$0·2 per cent nitrogen and 10 p.p.m. oxygen) in commercially available argon make it unsuitable for certain purposes, particularly high temperature experiments with uranium. A plant has been built at the Atomic Energy Research Establishment, Harwell, Chemical Engineering Division, to purify commercial argon and provide a supply with less than 50 p.p.m. nitrogen and 2 p.p.m. oxygen. The plant was intended primarily to supply a furnace chamber which had a capacity of 70 ft^3 and operated at absolute pressures not exceeding 1 atmosphere; it would also fulfil the requirements of a number of smaller furnace chambers operating at pressures up to 30 lb/in^2 gauge.

Industrial News

Home and Overseas

A Visit to London Metal Exchange

On Thursday of last week His Excellency Gunnar Hagglof, G.C.V.O., the Swedish Ambassador to the United Kingdom, visited the London Metal Exchange. He watched dealings in the four metals—copper, tin, lead and zinc—during the official morning session. His visit followed on being the speaker to reply on behalf of the guests at the London Metal Exchange dinner last April.

Afterwards, His Excellency attended a private lunch given by Brigadier H. P. Crossland, C.B., C.B.E., M.C., T.D., D.L., chairman of the board of the Metal Market and Exchange Company Limited, and Mr. P. G. Smith, chairman of the committee of the London Metal Exchange.

Aluminium Pipe

Large-scale production of aluminium pipe in sizes up to 28 in. dia. is stated to be now possible, due to the successful adaptation to aluminium of the helical-weld method of tube making. This tubing is now being offered, it is understood, in sizes from 6 in. to 28 in. dia. with wall thicknesses up to ¼ in., by three British companies—Apitubes Ltd., Bristol Aerojet Ltd. and the British Steel Piling Company Ltd.

The first-named company is producing pipe on helical-weld equipment designed and built at their Jarrow-on-Tyne works, and Bristol Aerojet have developed a different type of machine which produces helical-weld tube to exceptionally close tolerances for the more specialized types of application. The British Steel Piling Company are operating a "Driam" helical-weld machine at their works near Ipswich.

For all trials on helical-weld machines in this country **Alcan Industries Ltd.** advised on machine adaptation and supplied Noral strip up to ¼ in. thick in large coils of the higher strength alloys. Their associates, **Aluminium Laboratories Ltd.**, fitted the MIG and TIG welding equipment to the machines and established correct welding procedures. The introduction of helical-weld aluminium pipe means that a new assessment of the role of aluminium in pipework is possible because it can now be obtained in a wider range of sizes.

New Home for Royce

In a new factory occupying a prominent corner position in the industrial development area at Sheerwater, in Surrey, **Royce Electric Furnaces Ltd.** has been rehoused and re-equipped to cope with the increasing demand for the special furnaces it manufactures. It is understood that popular demand is for "packaged units" which do not involve assembly work on site, and most of the Royce furnaces, whether of standard design or made to meet precise requirements, are delivered bricked and wired, and needing only connection to an electricity supply to be put into commission.

The new factory has a floor space of about 40,000 ft^2 and is arranged to provide two main bays, 190 ft. in length, for the manufacturing and assembly work, which involves metal cutting and fabrication, laying insulating brickwork and refractories, and electrical installations. A machine shop occupies one side of the factory and on the other are stores, works offices and canteen.

A new feature in the electrical section is a furnace-testing panel with an elaborate array of switches, instruments and dials, enabling a comprehensive check to be made on heating uniformity, electrical circuits, controls and insulation. Modern equipment for cutting hard refractories and thermal insulation boards is installed in a dustproof room. Our illustration on this page shows the laying of insulation brickwork in a Royce furnace.

A Modernization Plan

A multi-million dollar programme to modernize its brass operations and raise production capacity was announced in New York by the Olin Mathieson Chemical Corporation. "This project will strengthen the market position of Olin brass and reinforce its reputation for quality by incorporating the latest technological improvements in brass and copper casting, annealing, rolling and fabricating", according to Mr. Milton L. Herzog, vice-president of the corporation and general manager of the metals division.

Scheduled to be completed in early 1964, the programme will include the construction of an entirely new brass and copper casting and rolling plant in East Alton, Illinois; the replacement and modernization of various finishing mills, annealing, slitting and other facilities at the present Olin brass mills at East Alton and at New Haven, Connecticut, as well as modernization of brass fabricating facilities.

Malayan Tin Shipments

The Straits Trading Company reports that tin shipments from Penang in the first half of August totalled 2,611½ tons, against 2,321½ tons in the first half of July. The latest total comprised 60 tons to the U.K., 1,200 to the U.S., 644 to the Continent, 50 to Canada, 453 to Japan, 22 to the Pacific, 72½ to India, 38 to South America, 42 to Australasia and 30 to the Middle East.

Shipments from Singapore in the first half of August were 1¼ tons, all to India, compared with 200¼ tons shipped in the same period in July.

Semi-Tubular Rivet Range

A new range of drilled, semi-tubular rivets is now being produced by **Cooper and Turner Limited.** These rivets are being turned out in mild steel, copper, brass and aluminium alloys to British Standard specifications and particularly to special order, as, for example, where special head shapes and sizes are required.

The size range is from ⅛ in. to ⅜ in. diameter and up to 6½ in. length.

Light Alloy Lighting Columns

Four light alloy lighting columns by **Alf'd Miles Ltd.**—a member of the Hawker Siddeley Group—are to be displayed at Scarborough in October during the annual conference of the **Public Lighting Engineers.** The material used in the

Laying insulation brickwork in a Royce furnace

manufacture of these columns—the 15 ft. columns weigh only 35 lb.—is B.S.1470 N.S.5, which has a very high resistance to corrosion, increased by the sandblast finish.

Industrial and Sewage Sludges

Treatment of industrial wastes, and of sewage, to produce liquids of a suitable quality for discharge to river (or, in the case of industry, to sewer) almost invariably results in the retention of slurries and sludges. Their treatment and disposal poses perhaps the greatest problem facing those concerned with waste water technology today.

The Metropolitan and Southern branch of the **Institute of Sewage Purification** is therefore to hold a one-day Symposium on this subject on Wednesday, December 20 next in the Main Hall, Friends' House, Euston Road, London, N.W.1. Six Papers will be presented for discussion.

The hon. secretary of the Symposium is Mr. A. F. Green, B.Sc., F.R.I.C., 37 Frensham Road, New Eltham, London, S.E.9, from whom all details relating to this event may be obtained.

Panel to Aid Exporters

The North Midland Regional Council of the F.B.I. has organized a panel of export experts to assist smaller firms in the problems of exporting. Members of the panel are prepared to give practical and personal help to novice exporters within the same industry or type of industry.

The local Chambers of Commerce, the N.U.M. and four local hosiery manufacturers' associations have pledged their support for the panel. The panel consists of 14 members covering the principal industries in the North Midlands, including engineering, furniture, plastics, leather, shoes, hosiery and knitwear and other branches of the textile industry.

Alumina from Clay

According to a news report from Warsaw, the first ton of alumina obtained from ordinary clay has been sent from a testing laboratory to the aluminium foundry in Skawine, Cracow. The alumina was obtained by the method of Professor Bretsznajder, a Polish chemist, after many years of research. A specially appointed commission of the Polish Academy of Sciences has approved the new method and has proposed the construction of a big alumina plant with a capacity of 200,000 tons a year. The plant is expected to be finished in 1964.

News from Birmingham

A lull in the placing of new business is usual at this season, but it has been more marked this year because of the economic situation. A moderate amount of work is in hand in rolling mills and foundries. The amount of building work in progress is a bright feature in an otherwise dull situation and this is finding work for many firms producing castings and pressings. Household appliance sales are declining sharply. The trend was evident before the new financial restrictions were imposed but it has become more marked in the last few weeks, and has had an adverse effect on business in light metal castings.

In the iron and steel market the outlook is uncertain, but there is a trend to easier conditions all round. Less steel for constructional engineering is likely to be required during the coming autumn and winter because local authorities and government departments will be obliged to curb expenditure wherever possible. Stocks of most grades of iron and steel are ample to meet all requirements. The re-rollers have good supplies of semi-finished steel. There is still a brisk market for reinforcing bars and rods. The engineering industries are good customers for heavy castings and forgings.

News from Paris

Because of rising consumption and greater competition, the Cie Generale du Duralumin et du Cuivre is planning to install a new aluminium rolling mill. Work on the new plant will start shortly. This is apart from new installations and modernization of existing plant under a new investment plan amounting to £2,000,750, which will be completed by the end of 1962. It is pointed out that owing to the rapid development of the industry it was now necessary to equip existing factories with the latest installations. These include, particularly, new presses up to 5,000 tons and new installations for the manufacture of aluminium tube.

Aleurope (Aluminium Europe) is the title of a new company formed in Brussels. The new group includes three Belgian companies and Reynolds International Inc., Reynolds Bermuda and Reynolds Overseas Corporation. It will have a capital made up of 100,000 Belgian franc shares.

Penarroya has issued its half-yearly figures. Lead production is given as 73,057 tons, zinc 80,722 tons, and copper 20,357 tons. Figures for ores mined are: lead 80,907 tons, zinc 19,871 tons, and copper, 5,780 tons. Morocco produced most lead ore, 27,310 tons, followed by Spain, 13,678 tons, and then France, 13,651 tons. Italy also produced over 13 tons and Greece and Iran, almost 2 tons each. France topped the list for lead metal with 37,001 tons, followed by Spain with 22,965 tons, Italy with 10,042 tons, and then Greece and Tunisia. For zinc ores, France produced only 11,084 tons, against Italy's 59,452 tons. Algerian, Spanish and Greek production was small. Italy also produced most zinc metal, 11,760 tons, against only 8,111 tons for France. Chile produced 19,412 tons of copper ores and Algeria 945 tons.

French aluminium production for the first half of the year is given as 131,381 tons, against 108,870 tons for the same period last year. This shows an increase of 24 per cent.

It is pointed out that the French contribution to the Alucam production is not included in these figures and is given as 17,830 tons, against 17,000 tons.

Australian Copper Mine

It is reported from Perth that two Japanese companies have acquired between them an 85 per cent shareholding in a Western Australian copper mining company, the Depuch Shipping and Mining Company Pty. Limited. The Japanese companies are Rasa Trading and Dowa Mining.

The Depuch Company has an option over the Whim Well and Mons Cupri copper mines at Whim Creek, between Roeburne and Port Hedland, in the far north-west. The Whim Creek mines were big producers until the end of the first World War, when a copper slump closed them.

Test Data Booklet

A new publication has been issued by **Combustion Chemicals Limited** giving typical results from the use of "Desulfurol" fuel treatment in furnace, oven and kiln operation. This follows the recent publication of the companion booklet covering boiler application.

The data presented in this new booklet give ample proof of the ability of Desulfurol, when added to the fuel oil at one part per thousand, to alleviate such problems as burner coking, sulphur fumes and sulphur contamination of the products or wares.

International Colloquim

Advance notice is given of an International Colloquim on **Forming and Testing of Sheet Metal** which is to be held under the joint aegis of the International Deep Drawing Research Group and the Verein Deutscher Eisenhüttenleute.

The venue for this meeting is Düsseldorf on May 23 and 24 next year, and it is proposed to devote the open sessions of this meeting to the presentation and discussion of Papers on the following two themes:—

(1) Speed effects in sheet metal forming (effect of speed of deformation in deep drawing or other sheet forming processes; forming at very high speeds; explosive forming), and (2) the influence of surface conditions on deep drawing (effect of sheet metal surface, including metallic or non-metallic coatings; influence of tool surfaces; lubricants and lubrication).

Offers of Papers or requests for further information regarding this event should be addressed to Mr. John Hooper, secretary of the International Deep Drawing Research Group, John Adam House, John Adam Street, Adelphi, London, W.C.2.

Tall Tower for Mobiloil

A steel fractionating column weighing 54 tons has been made at the Greenwich works of **G. A. Harvey and Co. (London) Limited** to the design and order of the Kellogg International Corporation for Mobiloil's refinery at Coryton.

The column, which was completed on time to Kellogg's required delivery date, has a main shell 109 ft. long and 10 ft. in

LIGHT METALS STATISTICS IN JAPAN (May 1961)

Classification	Production	Shipment	Stock	Export
Alumina	34,096	39,530	16,906	12,856
Super purity Al	82	81	697	0
Primary Al	12,983	13,424	2,012	0
Secondary Al	5,061	5,163	1,155	0
Wrought products (Al and its alloy)	14,089	13,474	4,483	939
Plate, sheet and strip	9,108	9,044	2,668	
Foil	990	1,000	347	807
Rolled and extruded shape	2,263	1,978	468	
Forgings	44	—	—	—
Electric wire	1,684	1,452	1,000	132
Powder, flake and paste	—	—	—	—
Casting	6,229	—	—	—
Sand and permanent mould	3,453	—	—	—
Die	2,776	—	—	—
Sheet products	2,650	2,576	1,232	131
Primary Mg	216	222	72	—
Secondary Mg	230	261	340	—
Mg casting	29	—	—	—
Sponge Ti	169	159	1,101	109
Super purity Al (June)	85	90	692	—
Primary Al (June)	12,904	13,309	2,607	0

diameter. It is made of mild steel plate, ⅜ in. thick, and has at each end a dished and flanged head, spun and formed on Harveys' Rotarpress. Before leaving Greenwich the column was subjected to a hydraulic pressure test of 110 lb/in^2. This fractionating column is the longest one fabricated by Harveys for 18 months and represents a new addition to the plant at the refinery, where it will be used in the processing of crude oil.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 92 tons to 5,919 tons, comprising London 2,850, Liverpool 1,803 and Hull 1,266. Copper stocks rose 98 tons to 21,839, comprising London 675, Liverpool 17,114, Birmingham 50, Manchester 3,925, Hull 50, and Glasgow 25. Lead duty-free stocks rose 50 tons to 7,156 tons, comprising London 6,881, Glasgow 100, and Swansea 175. In-bond stocks fell 341 tons to 2,802 tons (all in London). Zinc duty-free stocks rose 252 tons to 4,076, comprising London 2,722, Glasgow 176, Hull 400, Manchester 400, and Liverpool 378. In-bond stocks rose 500 tons to 2,935 (all in London).

Imported Cadmium Metal

The Board of Trade give notice that they are considering an application for the allowance of drawback of duty on imported cadmium metal when used for the production in the United Kingdom of exported cadmium colours.

Representations which interested parties may wish to make about this application should be addressed in writing to the Board of Trade, Tariff and Import Policy Division, Horse Guards Avenue, London, S.W.1, not later than September 11, 1961.

Clean Air Act

In order to assist its members in connection with an application it is proposed to make to the appropriate Ministry regarding the desire of the trade to have the treatment of scrap cable registered under the Alkali and Works Regulation Act, the **National Association of Non-Ferrous Scrap Metal Merchants** is seeking the views of its members.

The association has therefore circulated to its members an extract from a circular which was previously sent out in which was set out the reason which led the association at that time to feel that registration under the Alkali Act would be an advantage.

"Section 17 of the Clean Air Act, which is headed 'Special Cases', lays down that, subject to certain provisions, the Clean Air Act shall not apply to premises which are controlled under the Alkali Act. The Alkali Act, however, which originally dealt only with the emission of noxious or offensive gases, will then have effect in relation to smoke, grit and dust emitted from any premises registered under that Act.

"Proceedings, however, could be taken in respect of offences by works registered under the Alkali Act under sections 1, 5 and 16 of the Clean Air Act, but only with the consent of the Minister. The Minister also has the power, on the application of the Local Authority, to make an order whereby the exemptions conferred by Clause 17 on works registered under the Alkali Act are withdrawn.

"To summarize the position, if works treating scrap cable are registered under the Alkali Act, the Local Authorities will only be able to institute proceedings for smoke nuisance after obtaining the consent of the Minister, which it is certain will not be given without good reason. Works will, however, be liable to prosecution instituted by the Alkali Inspector under the Alkali Act of 1906."

Appointments

At a meeting of the board of **Samuel Osborn and Company Ltd.,** Mr. Cecil F. Hurst was appointed assistant managing director of the company.

The **U.K. Atomic Energy Authority** has agreed to release Mr. P. T. Fletcher, B.Sc., M.I.Mech.E., M.I.C.E., M.I.E.E. (previously deputy managing director, Development and Engineering Group at Riseley and, since April, special adviser to the Member for Reactors), to take up the appointment, as from October 1 next, of director responsible to the board of the **United Power Company Limited** for construction and supply.

United Power Company Limited was recently formed to unite the nuclear engineering activities of Atomic Power Constructions Ltd. and the G.E.C. and Simon-Carves Atomic Energy Group.

Packaging Exhibition

On Tuesday, September 5 next, the **International Packaging Exhibition** will open at the Grand and National Halls, Olympia, London, and will remain open until September 15 next.

Meeting in Detroit

From October 1 to 5 this year the **Electrochemical Society Inc.** will be holding a meeting at which six divisions of the society will hold technical sessions. These divisions include the Corrosion, Electrodeposition, the Electrothermics and Metallurgy divisions.

Ambulance Facilities

Draft regulations published by the Ministry of Labour this week require occupiers of certain factories and other premises in Great Britain to nominate a responsible person to be always available during working hours to summon an ambulance. The premises to which these regulations apply are blast furnaces, copper mills, iron mills and foundries, metal works, saw mills and factories in which articles of wood are manufactured in any of which 500 or more persons are employed, and all chemical works.

They replace a requirement under the Factories Act, 1937, that occupiers of factories shall provide and maintain an ambulance unless they have made arrangements for one to be obtained. The Draft Blast Furnace and Saw Mills Ambulance (Amendment) Regulations, 1961, and The Draft Chemical Works Ambulance (Amendment) Regulations, 1961, may be obtained from H.M. Stationery Office.

Safety Regulations

A comprehensive code of safety regulations covering more than one million workers in the construction industry in Great Britain will come into operation on March 1 next year. This is the effect of two orders, made by the Minister of Labour, Mr. John Hare, which were presented to Parliament on Tuesday last.

The regulations incorporate amendments to the statutory drafts published in October 1960, recommended by Sir George Honeyman, Q.C., in his report on the public inquiry he held in February and March this year to hear objections to those drafts. This report was also published this week.

They are designed to provide protection for workers employed both above and below ground in the building and civil engineering industries. They impose requirements for the construction, use and examination of lifting appliances, lifting gear and lifting tackle used for building operations and works of engineering construction.

They also require the appointment of safety supervisors in firms employing more than 20 persons, the provision of safe working places and means of access to them, and include provision for the safety of excavations, shafts, tunnels, caissons, for the operation of vehicles, and for precautions in demolition work and a number of other matters. In the case of building operations the regulations replace similar requirements in the Building (Safety, Health and Welfare) Regulations, 1948. The regulations may be obtained from H.M. Stationery Office.

Thermocouples

A new publication which has been issued by the **Cambridge Instrument Company Limited** describes the company's standard range of rare- and base-metal thermocouples for temperatures up to 1,500°C. In general, thermocouples are manufactured to customers' specifications and for particular applications, but certain types of thermocouple assemblies which have been continuously in demand are now produced as a standard range. Details are given in this publication of the factors governing the choice of suitable assemblies for widely differing applications, and a simple three-letter coding system which simplifies the ordering of stock assemblies and replacement parts is described.

I.T.C. Meeting Postponed

The International Tin Council meeting has been postponed until mid-September. The date of the meeting is not yet fixed and no reason was given for the postponement. Originally, the Council was due to meet on August 22.

An I.T.C. spokesman declined to add to the official statement, but trade sources suggest a number of reasons for the postponement. The reason with most credence is that the Council are still awaiting replies from some member countries regarding the proposal to raise the price ranges within the agreement. Another suggestion is that no progress has been made in negotiations with the United States authorities towards releases from the strategic stockpiles.

The Council made it known after the last meeting in July that an approach had been made to the United States Administration for consultation regarding disposals from the strategic and supplementary stockpiles. Any agreed release arising from these negotiations would affect the overall supply position. Market quarters are, therefore, tying this in with the price structure proposals within the agreement.

In addition to the supply and price questions, market observers consider that another reason for the postponement might be the recent statement by Mr. Dillon, United States Treasury Secretary, at the Inter-American conference in Uruguay. He said, "We plan to discuss with the Tin Council at an early date the terms of

a possible United States accession to the agreement". The Tin Council has not disclosed whether a letter of application has yet been received but the postponement could be intended to give the United States authorities a little more time.

Showing at Hevac

Developments in commercial and industrial air heaters will be featured on the **Parkinson Cowan Group** stand at this year's International Heating, Ventilating and Air Conditioning Exhibition, when a wide range of products will be shown from three divisions of the Group. New products exhibited by Parkinson Cowan Industrial Products will include a commercial gas radiant heater, designed specially to bridge the gap between domestic and industrial heating appliances. It can be installed at low initial cost and is economic in use.

Other products from the same division will be a new gas unit air heater for use in large buildings with low roofs, and an infra red conveyorized oven suitable for such purposes as paint stoving, and drying and curing applications.

Bastian and Allen Limited will show two different forms of off-peak heating with controlled output—a Constor storage heater using warm air and an electrode hot water thermal storage boiler. For process steam they will be showing one of their well-known range of Speedylec packaged electrode steam boilers. Other products will include a Bantam hot water boiler and a Speedyjet steam cleaner. Visitors to the stand will be particularly interested in working models of an electrode steam boiler and a hot water boiler.

From Parkinson Cowan Measurement will be a range of pumps, liquid meters and motorized pumping sets of particular value for oil-fired heating installations.

Welding Equipment

An entirely new type of blowpipe is now available which, by a simple change of nozzle, can be converted from a cutting torch into a welding torch. Claimed to be the only torch of its type available in Britain, it does not require any conversion at the bottom of the shank. In addition, back-firing has been eliminated.

Called the Double Duty Demon, it weighs only 1¼ lb. and is simple to manipulate. It will cut sheet metal and steel plate up to 2 in. thick, and can weld steel up to ¼ in. thickness.

The handle to, the torch has been specially designed and constructed, being of non-metallic composition with a non-slip fluted grip. The torch is supplied with three welding and two cutting nozzles which will handle most of the requirements of everyday welding and cutting. This unit is marketed by **Suffolk Iron Foundry (1920) Ltd.**

New Representatives

Two new welding engineers have joined **Suffolk Iron Foundry (1920) Ltd.** as area technical representatives. They are Mr. H. Johnson, who will cover the Lancashire and North-West Coast areas, and Mr. H. B. Travis, who will represent the company in Yorkshire and the North-East Coast.

New Branch Office

It is announced by the **Kaiser Aluminum Company Limited** that they have opened a new branch office at Lichfield House, Smallbrook Ringway, Birmingham, 5.

Company Reports

Wickman and Company

Group net profit, year to March 31, 1961, £682,850 (£515,877), after £79,999 (nil) off jigs and tools, and dividend 11 per cent net on £2·8 million (10 per cent net on £2·1 million). Fixed assets £3,048,164 (£2,603,764), current assets £6,718,470 (£5,316,740) and liabilities £3,019,390 (£2,238,603). Commitments £70,000 (£35,000).

Public Company

It is announced that Walker, Crossweller and Company Ltd. is to become a public company, and an offer of sale of 300,000 Ordinary shares of 5s. each at 8s. 6d. per share was made on Monday last. The company manufactures and sells thermostatic mixing valves, and also gas and air flow and pressure and vacuum recorders and indicators to the steel, gas, cement, pottery and similar industries.

The directors consider that in the absence of unforeseen circumstances the profits for the current year should not be less than those for the year ended March 31, 1961, namely £87,726. On this basis the directors would recommend a total dividend for the year on the issued Ordinary shares of not less than 12½ per cent. At the price of 8s. 6d. per share the yield on this basis is £7 7s. 0d. per cent covered just over twice.

Mount Morgan

This Australian gold, copper and coal producing company has announced a final dividend of 7½ per cent, to make 15 per cent for the year ended June 25, 1961, against 20 per cent. The 1959-60 interim was paid on smaller capital—prior to Preference share conversion into Ordinary.

Metal Statistics

Detailed figures of the consumption and output of non-ferrous metals for the month of June, 1961 have been issued by the British Bureau of Non-Ferrous Metal Statistics, as follows in long tons:—

COPPER	Gross Weight	Copper Content
Wire	26,799	26,325
Rods, bars and sections	16,176	10,693
Sheet, strip and plate	14,418	11,526
Tubes	8,395	7,782
Castings and miscellaneous	8,088	—
Sulphate	3,073	—
	76,949	63,694

Of which:

Consumption of Virgin Copper	48,295
Consumption of Copper and Alloy Scrap (Copper Content)	15,399

LEAD	
Cables	8,977
Batteries	2,963
Battery Oxides	3,244
Tetra Ethyl Lead	1,973
Other Oxides and Compounds	1,804
White Lead	773
Shot	475
Sheet and Pipe	6,816
Foil and Collapsible Tubes	375
Other Rolled and Extruded	602
Solder	1,396
Alloys	1,799
Miscellaneous Uses	1,769
Total	32,966

TIN	
Tinplate	777
Tinning:	
Copper Wire	59
Steel Wire	8
All other	75
Solder	124
Alloys	560
Foil and Collapsible Tubes, etc.	55
Tin Compounds, Salts, and Miscellaneous Uses	164
Total Consumption	1,822

ZINC	
Galvanising	8,058
Brass	10,127
Rolled Zinc	2,643
Zinc Oxide	2,429
Zinc Die-casting alloy	5,375
Zinc Dust	1,078
Miscellaneous Uses	961
Total, All Trades	30,671

Of which:

High purity 99·99 per cent	6,069
Electrolytic and high grade 99·95 per cent	4,683
Prime Western, G.O.B. and de-based	12,151
Remelted	655
Scrap Brass and other Cu alloys	4,129
Scrap Zinc, alloys and residues	2,783

ANTIMONY	
Batteries	165
Other Antimonial Lead	42
Bearings	22
Oxides—for White Pigments	130
Oxides—other	80
Miscellaneous Uses	16
Sulphides	5
Total Consumption	460

Antimony in scrap	
For Antimonial Lead	512
For Other Uses	67
Total Consumption	579

CADMIUM	
Plating Anodes	57·80
Plating Salts	12·40
Alloys: Cadmium Copper	5·90
Alloys: Other	3·75
Batteries: Alkaline	3·95
Batteries: Dry	0·04
Solder	11·05
Colours	17,85
Miscellaneous Uses	2·55
Total Consumption	115·65

Metal Market News

THE July statistics were made available last week, the figures being, as usual, presented in short tons of 2,000 lb. On the whole, they were not very encouraging and the market dropped £1 or so when they were known. Inside the United States, production of crude copper amounted to 99,996 tons against 113,125 (revised) in June, while the output of refined metal amounted to 128,447 tons. This compared with 141,140 tons in the previous month. Deliveries to consumers fell by fully 26,000 tons, from 139,700 tons in June to 113,431 tons in July, while stocks of refined copper at 82,856 tons compared with 89,008 tons. Outside the U.S.A., the production of crude copper at 203,752 tons compared with 198,484 tons in June, while output of refined was nearly 10,000 tons up at 176,139 tons. Deliveries to consumers, on the other hand, dropped sharply from 199,246 tons to 172,267 tons. Stocks of refined copper in producers' hands rose from 312,652 tons (revised) at the end of June to 340,823 tons at July 31. The overall rise of 22,000 tons in stocks of refined copper suggests that, in spite of the curtailment programme in force, the increase in reserves of copper is not being checked. Of even greater significance, perhaps, is the decline of about 53,000 tons in the sum total of deliveries to consumers, even though part of this, at any rate, must be due to the incidence of the holiday season. But the extent of the decline is rather disconcerting.

On a narrower front, last week saw an advance of 90 tons in stocks of standard copper in L.M.E. warehouses, the revised figure being 21,741 tons. This is the smallest increase for several weeks and may be an indication that the big rise in tonnage is ended for the moment. As to the other metals, there was a drop of 125 tons in tin stocks to 6,011 tons and another large fall of 955 tons in the lead tonnage to 10,249 tons. In zinc, a decline was also seen, from 6,528 tons to 6,259 tons. In mid-July, lead stocks were over 13,000 tons, so that in the short period of one month there has been a fall of about 3,000 tons, but whether this will continue remains to be seen. This lead is presumably going into consumption, as it is known that supplies from Commonwealth sources are not so plentiful as they were. This fall in reserves has not particularly affected the contango, but the quotation itself has weakened to the extent of something like 25s. Last week saw a further marking down of the price to the tune of 15s. for both positions, and the turnover was only 4,500 tons. Cash closed at £64 and three months at £65 10s. 0d.

Tin and copper were the most active market last week, but even so their turnover figures were below average, and the same goes for lead and zinc. Copper, with a turnover of 10,325 tons, closed 30s. below the best at £230 for cash and £233 5s. 0d. three months, these quotations showing a loss of 25s. in each position. So far, the strikes in progress in Chile have really done nothing to help the market, and even the fact that *force majeure* notices were reported to have been issued made no difference. The fact is that nobody appears to be short of copper even though a substantial premium is reported to obtain for wirebars. Tin closed £4 to £5 below the best at £939 for cash and £950 10s. 0d. three months, these prices showing gains of £4 and £4 10s. 0d. for the respective positions. The market turned easy as news that the Tin Council meeting had been postponed to mid-September. Trading in zinc was very quiet with a turnover of only 3,725 tons, both positions losing 2s. 6d. at £76 17s. 6d. cash and £77 17s. 6d. three months.

New York

Copper futures were firmer on covering and new buying. Dealings were fair. The continued copper strike in Chile, and the fact that no settlement had been reached yet at the Kennecott Utah mine strike aided the market. Physical copper was firmer in the export market but quiet. Custom smelters indicated continued fair sales in September delivery. One leading domestic producer, unaffected by strikes, said his company was about sold out for September.

Scrap copper was unchanged. Tin was firmer but quiet. Offerings in all positions were made at 119$\frac{5}{8}$ cents and bids for October-November at 119$\frac{3}{8}$ cents per lb. Lead was quiet. Prime western zinc was fairly active.

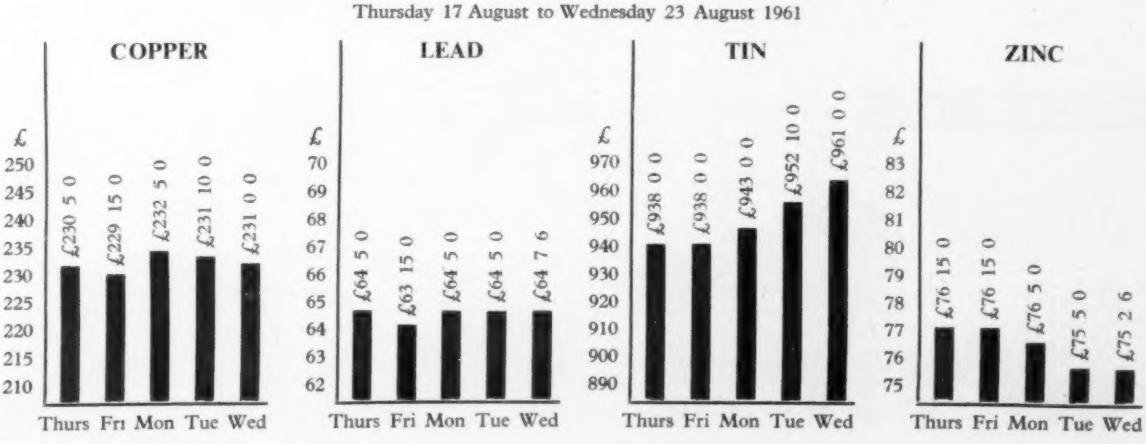
Leading fabricators have indicated they were following the recent 7$\frac{1}{2}$ per cent increase on certain types of copper water tube recently instituted by Lewin-Mathes Division of Cerro Corporation. Phelps Dodge Copper Products Corporation and Bridgeport Brass Company said they were taking action on the same date as the Lewin-Mathes effective date of increase. Chase Brass and Copper and Scovill Manufacturing Company said their higher prices would be effective August 25.

Domestic consumption of copper by brass and wire mills and foundries, based on their shipments of fabricated products in July, totalled 97,374 short tons compared with 122,467 tons in June, the U.S. Copper Association said.

New business booked by fabricators in terms of refined copper to be used amounted to 111,347 short tons (122,035). Unfilled orders on fabricators' books at end-July totalled 153,049 short tons (139,585).

London Metal Exchange

Thursday 17 August to Wednesday 23 August 1961



NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 23/8/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	,,	237	10	0
Antimony Metal 99%	,,	230	0	0
Antimony Oxide Commercial	,,	194	10	0
Antimony White Oxide	,,	212	0	0
Arsenic	,,	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	,,		11	0
Calcium	,,	2	0	0
Cerium 99%	,,	15	0	0
Chromium	,,		6	11
Cobalt	,,		12	0
Columbite per unit		8	0	0
Copper H.C. Electro	ton	231	0	0
Fire Refined 99·70%	,,	230	0	0
Fire Refined 99·50%	,,	229	0	0
Copper Sulphate	ton	78	0	0
Germanium	grm.	—		
Gold	oz.	12	10	9¼
Indium	,,		10	0
Iridium	,,	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	64	7	6
Magnesium Ingots	lb.			
99·8%	,,		2	2½
99·9+%	,,		2	3
Notched Bar	,,		2	9½
Powder Grade 4	,,		5	6
Alloy Ingot, AZ91X			1 11¾-2	1¼
Manganese Metal	ton	280	0	0
Mercury	flask	63	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	,,		5	11
Osmium	oz.	20	0	0
Osmiridium	,,	—		
Palladium	oz.	9	0	0
Platinum	,,	30	5	0
Rhodium	,,	46	0	0
Ruthenium	,,	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	7⅞
Tellurium Sticks	lb.	2	0	0
Tin	ton	961	0	0
***Zinc**				
Electrolytic	ton	—		
Min 99·99%	,,	—		
Virgin Min 98%	,,	75	12	6
Dust 95/97%	,,	121	10	0
Dust 98/99%	,,	127	10	0
Granulated 99+%	,,	100	12	6
Granulated 99·99+%	,,	113	1	3

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 23/8/61

		£	s.	d.
Aluminium Alloy (Virgin)				
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	,,	202	0	0
B.S. 1490 L.M.7	,,	216	0	0
B.S. 1490 L.M.8	,,	203	0	0
B.S. 1490 L.M.9	,,	203	0	0
B.S. 1490 L.M.10	,,	221	0	0
B.S. 1490 L.M.11	,,	215	0	0
B.S. 1490 L.M.12	,,	223	0	0
B.S. 1490 L.M.13	,,	216	0	0
B.S. 1490 L.M.14	,,	224	0	0
B.S. 1490 L.M.15	,,	210	0	0
B.S. 1490 L.M.16	,,	206	0	0
B.S. 1490 L.M.18	,,	203	0	0
B.S. 1490 L.M.22	,,	210	0	0
Aluminium Alloys (Secondary)				
B.S. 1490 L.M.1	ton	152	0	0
B.S. 1490 L.M.2	,,	152	0	0
B.S. 1490 L.M.4	,,	161	0	0
B.S. 1490 L.M.6	,,	176	0	0
***Aluminium Bronze**				
BSS 1400 AB.1	ton	243	0	0
BSS 1400 AB.2	,,	251	0	0
***Brass**				
BSS 1400-B3 65/35	ton	177	0	0
BSS 249	,,	—		
BSS 1400-B6 85/15	,,	223	0	0
***Gunmetal**				
R.C.H. 3/4% ton	,,	—		
(85/5/5/5) LG2	,,	219	0	0
(86/7/5/2) LG3	,,	229	0	0
(88/10/2/1)	,,	289	0	0
(88/10/2/½)	,,	299	0	0
***Manganese Bronze**				
BSS 1400 HTB1	,,	193	0	0
BSS 1400 HTB2	,,	214	0	0
BSS 1400 HTB3	,,	229	0	0
Nickel Silver				
Casting Quality 12%	,,	265	0	0
,, ,, 16%	,,	280	0	0
,, ,, 18%	,,	300	0	0
***Phosphor Bronze**				
B.S.1400P.B.1.(A.I.D. released)	,,	316	0	0
B.S. 1400 L.P.B.1	,,	243	0	0
Phosphor Copper				
10%	ton	257	0	0
15%	,,	260	0	0
Phosphor Tin				
5%	,,	1020	0	0
Silicon Bronze				
BSS 1400-SB1	,,	293	0	0
Solder, soft, BSS 219				
Grade C Tinmans	,,	424	10	0
Grade D Plumbers	,,	336	5	0
Grade M	,,	468	10	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.	—		
Type 9 ,,	,,	—		
Zinc Alloys				
BSS 1004 Alloy A	ton	106	11	3
BSS 1004 Alloy B	,,	110	11	3
Sodium-Zinc	lb.		2	6¼

**Average prices for the last week-end.*

SCRAP METALS

Merchants' average buying prices delivered, per ton, 22/8/61

	£
Aluminium	
New Cuttings	139
Old Rolled	104
Segregated Turnings	78
Brass	
Cuttings	161
Rod Ends	144
Heavy Yellow	137
Light	132
Rolled	147
Collected Scrap	134
Turnings	138
Copper	
Wire	207
Firebox, cut up	205
Heavy	204
Light	201
Cuttings	212
Turnings	188
Braziery	169
Gunmetal	
Gear Wheels	200
Admiralty	200
Commercial	180
Turnings	175
Lead	
Scrap	54
Nickel	
Cuttings	—
Anodes	590
Phosphor Bronze	
Scrap	180
Turnings	175
Zinc	
Remelted	69
Cuttings	60
Old Zinc	39

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

Aluminium

		£	s.	d.
Sheet 10 S.W.G.	lb.		2	10½
Sheet 18 S.W.G.	,,		3	0½
Sheet 24 S.W.G.	,,		3	3½
Strip 10 S.W.G.	,,		2	10½
Strip 18 S.W.G.	,,		2	11½
Strip 24 S.W.G.	,,		3	1
Circles 22 S.W.G.	,,		3	4½
Circles 18 S.W.G.	,,		3	3½
Circles 12 S.W.G.	,,		3	2½
Plate as rolled	,,		2	10
Sections	,,		3	4
Wire 10 S.W.G.	,,		3	1½
Tubes 1 in. o.d. 16 S.W.G.	,,		4	4

Aluminium Alloys

		£	s.	d.
BS 1470. HS19W.				
Sheet 10 S.W.G.	,,		3	3
Sheet 18 S.W.G.	,,		3	5½
Sheet 24 S.W.G.	,,		4	1
Strip 10 S.W.G.	,,		3	3
Strip 18 S.W.G.	,,		3	4½
Strip 24 S.W.G.	,,		4	0½
BS1477. HP30M.				
Plate as rolled	,,		3	1
BS1470. HC15WP.				
Sheet 10 S.W.G.	,,		4	3
Sheet 18 S.W.G.	,,		4	8½
Sheet 24 S.W.G.	,,		5	8½
Strip 10 S.W.G.	,,		4	4
Strip 18 S.W.G.	,,		4	8½
Strip 24 S.W.G.	,,		5	4½

Aluminium Alloys—cont.

		£	s.	d.
BS1477. HPC15WP.				
Plate heat treated	lb.		3	10½
BS1475. HG19W.				
Wire 10 S.W.G.	,,		4	2
BS1471. HT19WP.				
Tubes 1 in. o.d. 16 S.W.G.	,,		5	5
BS1476. HE19WP.				
Sections	,,		3	4
Split tube				
19 S.W.G. (½")	,,		4	2
20 S.W.G. (⅜")	,,		3	11
21 S.W.G. (⅜")	,,		4	1
22 S.W.G. (¼")	,,		4	11
Welded tube 14 to 20 S.W.G. (sizes ½" to 1½")	,,	3/10½ to 5/8½		

Brass

		£	s.	d.
Tubes	lb.		1	9¾
Brazed Tubes	,,		3	3¼
Drawn Strip Sections	,,		3	3¼
Sheet	ton	198	15	0
Strip	,,	198	15	0
Extruded Bar	lb.		2	0⅜
Condenser Plate (Yellow Metal)	ton	186	0	0
Condenser Plate (Naval Brass)	,,	199	0	0
Wire	lb.		2	8½

Beryllium Copper

		£	s.	d.
Strip	lb.	1	4	11
Rod	,,	1	1	6
Wire	,,	1	4	9
Copper				
Tubes	lb.		2	3⅜
Sheet	ton	265	5	0
Strip	,,	265	5	0
H.C. Wire	,,	282	15	0
Cupro Nickel				
Tubes 70/30	lb.		3	8⅝
Lead				
Pipes (London)	ton	107	0	0
Sheet (London)	,,	104	15	0
Tellurium Lead	,,	£6 extra		
Nickel Silver				
Sheet and Strip 10%	lb.		3	11½
Wire 10%	,,		4	4½
Phosphor Bronze				
Wire	,,		4	2
Titanium (1,000 lb. lots)				
Billet 4½" to 18" dia.	lb.	47/-	48/-	
Rod ¼" to 4" dia.	,,	85/-	53/-	
Wire ·036"-232" dia.	,,	159/-	99/-	
Strip ·001" to ·048"	,,	350/-	68/-	
Sheet 8'×2'. 20 gauge	,,	73/-		
Tube, representative average gauge	,,	198/-		
Extrusions	,,	90/-		
Zinc				
Sheet	ton	113	5	0
Strip	,,	nom.		

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium

	fr/kg	£/ton	
Copper: electrolytic	31.75	232	1
Tin	131.40	971	0

Canada

	c/lb	£/ton	
Aluminium	26.00	210	12
Copper: electrolytic	30.00	243	0
Lead	10.50	81	0
Nickel	70.00	567	0
Zinc: Prime western	12.00	97	4
High grade 99.95	12.60	102	1
High grade 99.99	13.00	105	6

France

	fr/kg	£/ton	
Aluminium	2.43	179	11
Antimony 99·0	2.80	206	18
Cadmium	16.25	1,200	17
Copper: electrolytic	3.21	237	5
Lead	.95	70	4
Nickel	9.00	665	2
Tin	13.41	991	0
Zinc: Thermic	1.14	84	4
Zinc: electrolytic	1.22	90	3
Scrap			
Copper: electrolytic	2.85	210	12
Heavy copper	2.85	210	12
No. 1 copper wire	2.70	199	10
Brass rod ends	2.10	155	3
Zinc castings	.90	66	10
Lead	.87	64	5
Aluminium	1.75	129	6

Italy

	lire/kg	£/ton	
Aluminium	370	216	1
Antimony 99·0	485	283	4
Copper: wire bars 99.9	450	262	16
Lead	165	96	8
Nickel	1,300	805	14
Tin	1,750	1,022	0
Zinc: electrolytic	181	105	15
Scrap			
Aluminium soft sheet clippings (new)	305	178	2
Lead, soft, first quality	137	80	0
Lead, battery plates	77	45	19
Copper, first grade	370	216	0
Bronze, commercial gunmetal	410	239	8
Brass: heavy	275	160	12
Brass: light	260	152	16
Brass, bar turnings	275	160	12
Old zinc	105	61	6

Switzerland

	fr/kg	£/ton	
Aluminium	2.50	210	5
Copper: electrolytic	2.90	243	17
Lead	.80	67	5
Nickel	7.50	630	15
Tin	11.20	942	0
Zinc: High grade 99.99	1.04	87	10

Japan

Scrap	Yen per metric ton
Copper: electrolytic	292,000
Copper wire No. 1	270,000
Copper wire No. 2	268,000
Heavy copper	260,000
Light copper	237,000
Brass, new cuttings	198,000
Red brass scrap	215,000

West Germany

Scrap	D-marks per 100 kilos	£/ton	
Used copper wire	225	205	0
Heavy copper	220	200	8
Light copper	190	173	1
Heavy brass	145	132	1
Light brass	110	100	5
Soft lead	50	45	11
Zinc	50	45	11
Used aluminium unsorted	75	68	6

United States

	c/lb	£/ton	
Aluminium	26.00	207	4
Antimony 99·0	32.50	259	0
Cadmium	160.00	1,275	4
Copper: electrolytic	31.00	247	10
Lead	11.00	87	13
Nickel	81.25	647	11
Tin	119.12	949	8
Zinc: electrolytic	12.50	99	12

THE STOCK EXCHANGE

Conditions Remained Quiet

ISSUED CAPITAL ●	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 18 AUG.	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	31/3		11	9	7 0 9	33/9	26/3	35/-	26/6
400,000	2/-	Anti-Attrition Metal	1/3		NIL	4	NIL	1/3¾	0/9	1/6	0/9
43,133,593	Stk. (£1)	Associated Electrical Industries ...	35/3		15	15	8 10 3	54/10½	35/-	67/3	38/3
3,895,963	1	Birfield	61/6	—1/6	10	15‡	3 5 0	78/9	45/-	51/3	29/-
4,795,000	1	Birmid Industries	76/-	—1/3	20	20D	5 5 3	103/-	71/3	74/9	56/-
8,445,516	Stk. (10/-)	Birmingham Small Arms	22/9	+3d.	17½QT	12½	5 6 0	36/10½	20/6	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/-		5	5	7 2 9	14/6	13/1½	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/-	—6d.	6	6	7 5 6	17/6	15/6	20/-	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	15/9		6	6	7 10 0	18/-	15/3	21/1½	17/7½
18,846,647	Stk. (£1)	British Insulated Callender's Cables	58/6	+6d.	13½	13½	4 12 3	62/3	49/-	61/4½	47/-
20,456,599	5/-	British Oxygen Co. Ltd., Ord. ...	18/6		16D	16	2 17 9	28/4½	17/6	35/-	19/10½
1,200,000	Stk. (5/-)	Canning (W.) & Co.	15/6		15⅝	25+*2½C‡	5 0 0	20/9	13/7½	19/9	13/7½
60,484	1/-	Carr (Chas.)	1/1½		NIL	12½	—	1/7½	10½d.	2/3	1/-
555,000	1	Clifford (Chas.) Ltd.	29/6		12	10	8 2 6	31/-	26/-	35/-	28/9
45,000	1	Ditto Cum. Pref. 6%	15/-		6	6	8 0 0	15/3	15/-	16/-	15/10½
300,000	2/-	Coley Metals	3/-	—3d.	15	15	10 0 0	4/5½	3/-	5/-	3/4½
10,185,696	1	Cons. Zinc Corp.†	63/-	—9d.	20	15	5 17 9	81/6	63/-	80/9	59/6
5,399,056	1	Davy-Ashmore	141/6		27½	22½	3 17 3	177/6	129/6	147/3	99/6
8,000,000	5/-	Delta Metal	21/3	+3d.	20	17½	4 14 0	27/7½	19/9	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	40/-		15	15	7 10 0	52/3	39/-	56/9	45/-
1,155,000	1	Evered & Co.	43/6		10	10ɸB	4 12 0	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	29/-	—3d.	10	10	6 18 0	39/6	29/-	47/9	29/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	56/9	+6d.	25	20	4 8 0	65/-	42/9	52/6	40/-
937,500	5/-	Glacier Metal Co. Ltd.	18/6		15	13	4 1 0	21/1½	13/9	16/1½	11/1½
2,500,000	5/-	Glynwed Tubes	25/-		22½	25¶	4 10 0	30/3	23/-	27/6	17/-
7,228,065	10/-	Goodlass Wall & Lead Industries ...	34/3		15	19L	4 7 9	44/9	32/6	41/9	33/-
696,780	10/-	Greenwood & Batley	19/-	—1/-	15	30‡	7 18 0	29/6	19/-	33/6	29/1½
792,000	5/-	Harrison (B'ham) Ord.	9/6	—6d.	*10	*20‡	5 5 3	14/6	9/6	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	19/9		7	7	7 1 9	20/4½	19/7½	23/6	22/-
1,612,750	5/-	Heenan Group	13/-		13	15	5 0 0	17/1½	10/6	13/-	9/10½
251,689,407	Stk. (£1)	Imperial Chemical Industries ...	63/6		13¾	11¼	4 0 3	81/6	63/1½	76/6	54/-
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/4½		5	5	6 19 3	16/-	13/10½	18/-	15/4½
29,196,118	**	International Nickel	153½		$1.60	$1.50	1 16 0	160	104	105	84¾
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/-		5	5	7 2 9	14/10½	13/6	16/6	14/6
6,000,000	1	Ditto Ord.	72/6		15	12	4 6 3	75/-	57/6	67/6	44/9
600,000	10/-	Keith, Blackman	17/-	—6d.	17½	17½E	10 6 0	21/6	16/10½	32/6	17/6
320,000	4/-	London Aluminium	11/10½		13	12	4 7 6	15/-	8/6	12/6	7/10½
765,012	1	McKechnie Bros. Ord.	43/9xcap	+3/3	12½K	17½F	5 14 6	53/6	35/4	71/6	57/3
1,530,024	1	Ditto A. Ord.	35/-xcap	—2/3	12½K	17½F	7 2 9	53/3	35/-	69/3	55/-
1,108,268	5/-	Manganese Bronze & Brass	13/6		20⅝	20⅝	7 14 3	18/6	12/7½	18/6	13/4½
50,628	6/-	Ditto (7½% N.C. Pref.)	5/6		7½	7½	8 3 6	6/-	5/-	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	83/-		12	12M	2 17 9	100/9	68/3	84/3	61/-
415,760	Stk. (2/-)	Metal Traders	7/6		50	50	3 6 9	8/9	6/9	10/9	7/1½
160,000	1	Mint (The) Birmingham	33/9		15 G	12½	5 18 3	35/9	24/-	39/-	33/6
80,000	5	Ditto Pref. 6%	72/-		6	6	8 6 9	77/6	72/-	80/-	75/-
5,187,938	Stk. (£1)	Morgan Crucible A	56/3	—6d.	14	13	4 19 6	71/3	53/4½	63/-	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	14/6		5½	5½	7 11 9	17/-	14/1½	18/9	15/9
3,850,000	Stk. (£1)	Murex	41/-	—1/9	13	22½J	6 6 9	52/-	39/9	45/-	35/3
585,000	5/-	Ratcliffs (Great Bridge) Ord. ...	16/3		10	10R	3 1 6	16/6	15/9	17/-	14/9
195,000	5/-	Ditto 8% Max. Ord.	5/-		8	—	8 0 0	5/1½	4/9	5/3	5/-
1,064,880	10/-	Sanderson Kayser	32/-	+1/-	17½	35‡	5 9 6	41/3	29/-	40/3	27/7½
3,400,500	Stk. (5/-)	Serck	15/-	—9d.	12½	17½GD	4 3 3	19/3	14/9	25/6	15/3
8,035,372	Stk. (£1)	Stone-Platt Industries	53/6	—1/6	16	15	5 19 9	67/-	50/-	64/4½	52/3
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	14/-		5½	5½	7 17 3	18/-	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	63/-	—6d.	14	20	4 8 9	85/6	62/4½	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	33/-	+3d.	10	10	6 1 3	38/3	28/-	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/-		5	5	7 13 9	15/-	12/7½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	18/6		*5	*5	8 0 3A	21/1½	18/3	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord.	72/6	+6d.	13¾	25	3 15 6	84/6	64/6	94/-	63/-
7,109,424	Stk. (£1)	Westinghouse Brake	33/6	—6d.	11	10	6 11 3	46/3	32/6	60/6	37/6
323,773	2/-	Wolverhampton Die-Casting ...	8/6		35	30	8 4 9	13/4½	8/3	13/10½	8/1½
591,000	5/-	Wolverhampton Metal	22/-		32½	32½	7 10 0	30/-	21/9	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	4/4½		15	20‡	8 11 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	13/1½		6	6	9 2 9	13/7½	13/-	15/-	13/6
150,000	1/-	Zinc Alloy Rust Proof	4/6		40	30	8 17 9	5/6	4/6	5/4½	4/-

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. ● The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. ɸ and 6¼% from Capital Profits. B and 50% capitalized issue G And 50% capitalized issue. F and special 5% tax free dividend and 50% Capitalized issue. H As forecast. ¶And 3 for 7 capitalized Issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. S and 40% capitalized issue. O calculated at 13¾%. Q also 1/- special tax free dividend and 50% capitalized issue T Per £1 unit. Interim on smaller capital. P calculated at 11½% The Thomas Bolton Capital has been acquired by British Insulated Callender's Cables. K Forecast dividend. Z After capital reorganization.

Forced-air circulation at 1100°C

An important advance in furnace design by

HEDIN

This highly successful furnace was designed and constructed by us to meet the following ROLLS-ROYCE specification:

1. variable temperature range up to 1,100°C.
2. tolerance of ±10°C. throughout the range
3. even temperature distribution all through
4. heating chamber size 4′ 6″ × 4′ 6″ × 5′ 0″

We overcame the problems involved by using forced-air circulation with the fan assemblies made of 'Nimonic 75' heat resisting alloys mounted on air-cooled tubular shafts. The air guide, which was also made of 'Nimonic 75,' was supported from the roof to reduce distortion at maximum temperature. The heating elements were housed in refractory grooves to facilitate easy replacement even with the furnace still relatively hot.

Tests before shipping were entirely successful, the temperature variation being ±5°C. at 750°C. and negligible at 1,100°C. The furnace is used for the heat treatment of Rolls-Royce 'Conway,' 'Avon,' and 'Dart' jet engine assemblies.

For your next electric furnace consult HEDIN INDUSTRIAL ELECTRIC HEATING SPECIALISTS

HEDIN LIMITED, FOWLER ROAD, HAINAULT, ESSEX
Telephone: HAInault 3031

CONRAD M. CARLSRUD

MECHANICAL ENGINEER
INDUSTRIAL CONSULTANT
REG. PROFESSIONAL ENGINEER

122 Clowes Terrace, Waterbury, Connecticut, U.S.A.

Planning and Layout of Modern Metal Works

Copper, Brass, Nickel, Silver, Aluminium for Production of Sheet, Tube, Wire Rods and Shapes

Extrusion, Hot-Coiler

Design of Melting and Annealing Furnaces

Watercooled Moulds for Flat Bars, Round Billets, Shells

Bull Blocks for Floating Plug-Draws.

Flying Shears in Conjunction with Tube Straighteners, Modern Draw-Benches

Complete Production Schedules

MATERIAL HANDLING IN WORKS STORES

THE FORK-LIFT TRUCK AND PALLET SYSTEM

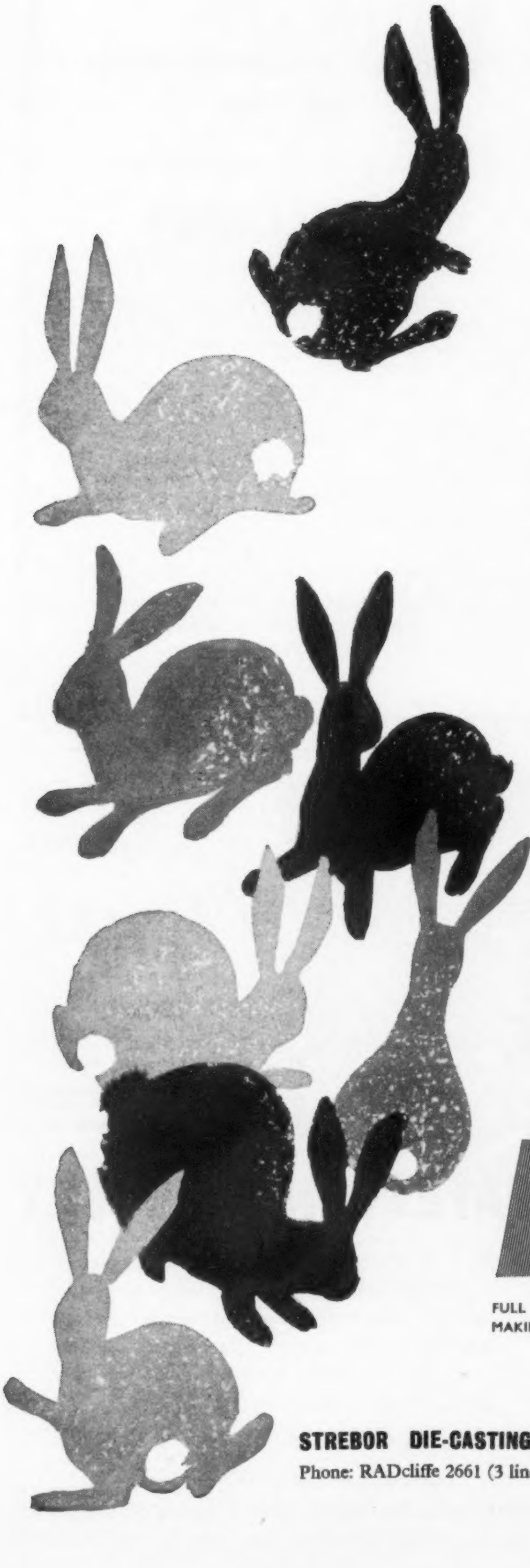
This unique book must be read by everyone concerned in any way with industrial storekeeping. Written by L. J. Hoefkens . . . lavishly illustrated . . . with many new sections and useful reference material added . . . it demonstrates convincingly all the practical advantages of the fork-lift truck and pallet system.

CONTENTS

Foreword by Sir Walter Puckey. PART ONE (Theory): Introduction; Fork Trucks and Pallets; Planning and Introducing New Methods. PART TWO (Practice): Examples from Practice; Receiving Department; Raw Material Store; Finished Part Store; Finished Equipment Store; Despatch Department; Provisioning Equipment and Space; Material Movement Control; Swarf and Scrap Handling; Handling and Storing Bar Material; Incentive Schemes for Non-productive Workers; Fork-Lift Truck Operating Costs; Fork-Lift Truck Maintenance; Conclusion. APPENDIX. INDEX.

2nd Edition 196pp. 18s. net By post 19s.

Obtainable from booksellers. Published by :—
***ILIFFE** BOOKS LTD*
DORSET HOUSE STAMFORD ST LONDON SE1



Classified Advertisements

Rate: Advertisements set in run-on style **5d.** per word, minimum **5/-**. Semi-displayed announcements are charged at **27/6** per inch depth. Box Numbers: add 5 words, plus 1/- for registration and forwarding replies. "Copy" accepted at London Office up to 1st post on each Friday for the following Friday's issue.

Series Discounts: Details upon application to "Metal Industry," Dorset House Stamford Street, London, S.E.1. Remittances payable to "Metal Industry". The proprietors retain the right to refuse or withdraw "copy" at their discretion and accept no responsibility for matters arising from clerical or printers' errors.

APPOINTMENTS VACANT

HEAT Treatment Foreman required by Douglas (Kingswood) Limited, Kingswood, Bristol, with experience in liquid/gas, pack and salt bath carburizing, cyclic annealing, atmosphere controlled furnaces and general tool hardening.

PLEASE apply, giving details of past experience and present salary to Personnel Manager. [8420

WORKS Manager required for Foundry in North-West London. The essential requirements are: age limit 30-40, a thorough knowledge of tool shop management and sound die-casting foundry experience. This appointment provides scope for man with energy, drive and initiative. Apply Box 4373, c/o Metal Industry. [8410

CAPACITY AVAILABLE

SURFACE Finishing of Contoured Parts. Internal and External, up to 12" dia. and 18" long. Elliptical, Square, Rectangular, Hexagonal, Octagonal, etc.

ARMYTAGE BROS. (KNOTTINGLEY) Ltd., Foundry Lane, Knottingley, Yorkshire. Telephone Knottingley 2743-4. [0001

KELLERING and Cam Profiling Capacity up to 8 ft × 6 ft., or 6 ft. diameter.

ARMYTAGE BROS. (KNOTTINGLEY) Ltd. The Foundry, Knottingley, Yorkshire. Tel. Knottingley 2743-4. [8364

SHEET Metal Fabrications of precision and repetitive nature a speciality. Wades (Halifax) Ltd., Arden Works, Fenton Road, Halifax. [0020

HEAT TREATMENTS

A.R.B.—D.G.I. APPROVED

ELECTRO HEAT TREATMENTS LTD.

BULL LANE, WEST BROMWICH, STAFFS. Telephone No.: Wes. 0584-0756.

BRIGHT Annealing. Bright Hardening. Case Hardening. Carbo Nitriding; Gas Carburizing; High Frequency.

LIGHT Alloys: Solution; Precipitation, up to 10 ft.

CONTROLLED atmospheres for all treatments, including hardening, annealing and tempering of ferrous and non-ferrous alloys.

LABORATORY SUPERVISION.
LOCAL DELIVERIES. [0005

MATERIALS FOR SALE

GENERAL POST OFFICE.

THE Postmaster General offers for sale 800 gallons of Used Acid from electropolishing processes, comprising approximately 45% Phosphoric Acid, 41% Sulphuric Acid and 14% Water, with iron content approximately 3% by weight; pH value less than 2.

THE acid is at Post Office Factory, Fordrough Lane, Birmingham, 9.

APPLICATIONS for forms of tender should be made to:—Director of Contracts, Post Office Contracts Dept. (Disposals), Telephone House, Temple Avenue, London, E.C.4. [8422

PLANT FOR SALE

PAIR of 21" × 39" Two-High Hot and Cold Rolling Mills by Taylor & Farley, with reduction gear fitted flywheels and 300 h.p. drive.

30" × 36" Two-High Reversing Mill by Davy United; motorized screw-down with 500 h.p. motor drive.

12" × 22" Two-High Rolling Mill with 75 h.p. drive.

9" × 21" Two-High Aluminium Foil Mill with 75 h.p. variable speed drive, let-off and coiler.

350 TON Hydraulic Stretcher with de-twisting gear.

100 TON Bigwood Stretcher for sections up to 26' long.

SCALPING Machine for billets 40" square.

REED BROTHERS (ENGINEERING) LTD.

(Receiver and Manager—Mr. C. E. M. Hardie)
WOOLWICH INDUSTRIAL ESTATE,
LONDON, S.E.18.
Tel.: Woolwich 7611. [8421

SCRAP METAL (SALE & WANTED)

URGENTLY REQUIRED

ZINC BASE ALLOY SCRAP
clean or contaminated
TURNINGS AND SKIMMINGS

MITCHAM SMELTERS LTD.

REDHOUSE ROAD,
MITCHAM ROAD,
CROYDON, SURREY. [0008

SCRAP METAL (SALE & WANTED)

B. J. PERRY & CO. LTD.

Exchange Buildings, Birmingham, 2
for Phosphor Bronze Swarf and Scrap
and all Non-Ferrous Metals.
Tel.: Midland 5986-7. [0113

NICKEL and High Nickel Content Scrap wanted. "Nimonics", "Inconel" "Monel", etc. Offer for best prices to Nicholson & Rhodes Ltd., Princess St., Sheffield, 4. Phone 27491. [0011

TIME RECORDERS

FACTORY Time Recorders. Rental Service. Phone Hop. 2239. Time Recorder Supply and Maintenance Co. Ltd., 157-159 Borough High Street, S.E.1. [0014

BOOKS

GAS Welding and Cutting: A Practical Guide to the Best Techniques. By C. G. Bainbridge, M.I.Mech.E., M.Inst.W., A comprehensive text-book providing practical information on almost the whole range of available gas welding and cutting equipment, methods and processes. Invaluable to the practical welder as well as to those responsible for gas welding and cutting operations involved in the fabrication and repair of industrial equipment. 15s. net from all booksellers. By post 16s. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

RESISTANCE Welding in Mass Production. By A. J. Hipperson, B.Sc.(Eng.), A.M.Inst.W., and T. Watson, M.Inst.W. The ground covered by this book ranges from the first principles of each process to its scientific application in mass production. Particular reference is made to design and production requirements. 21s. net from all booksellers. By post 22s. 1d. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

MATERIAL Handling in Works Stores. 2nd Edition. By L. J. Hoefkens. Shows how the use of fork-lift trucks and pallets in industrial stores can increase production, utilize floor space more effectively, help control of movement and reduce costs. Includes a description of a system actually operated in a modern factory. 18s. net from all booksellers. By post 19s. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED ADVERTISEMENTS

Use this Form for your Sales and Wants

To "Metal Industry" Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.I. Waterloo 3333

PLEASE INSERT THE ADVERTISEMENT INDICATED ON FORM BELOW

- RATE: 5d. PER WORD, MINIMUM 5/-.
  Name and address to be included in charge if used in advertisement.
- SEMI-DISPLAY: 27/6 PER INCH.
- BOX NUMBERS: If required 3/1 extra.
- PRESS DAY: 1st POST FRIDAY, for following Friday's issue.
  Cheques, etc. payable to "Metal Industry" and crossed "& Co."

NAME...

ADDRESS...

....

REMITTANCE VALUE. ....ENCLOSED

Please write in block letters with ball pen or pencil

NUMBER OF INSERTIONS.......................

INDEX TO ADVERTISEMENTS

Printed in Great Britain by James Cond Ltd., Charlotte St., Birmingham 3. Published by Iliffe Production Publications Ltd., Dorset House, Stamford St., London, S.E.1